CIVIL ENGINEERING

LAYING 108-IN. BYPASS AT MIAMI'S SEWAGE TREATMENT PLANT ON VIRGINIA KEY. SEE ARTICLE BY E. S. CHASE AND J. S. BETHEL, JR.

PROGRAM • BUFFALO CONVENTION • JUNE 3-7

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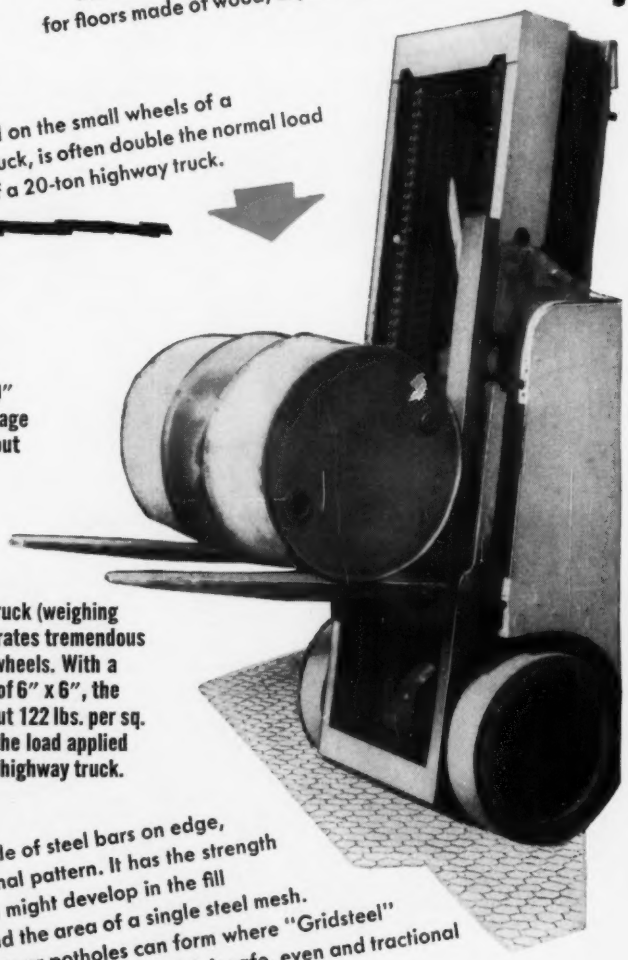
CAN YOUR FLOOR TAKE TODAY'S HEAVY TRAFFIC ?

The wear from heavily loaded industrial trucks and the impact from heavy objects often prove too severe for floors made of wood, asphalt or even concrete.

The concentrated load on the small wheels of a modern fork lift truck, is often double the normal load applied by the wheels of a 20-ton highway truck.



FOR EXAMPLE:

14" **16000 LBS.** 20"

H-20 TRUCK WHEEL CONTACT AREA

A 20-ton highway truck (with a wheel load of 16,000 lbs. on a 14" x 20" contact area) has an average load concentration of about 57 lbs. per square inch.

6" **4400 LBS.** 6"

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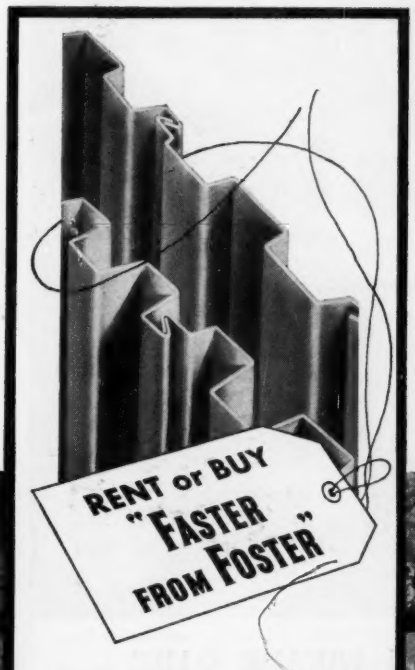

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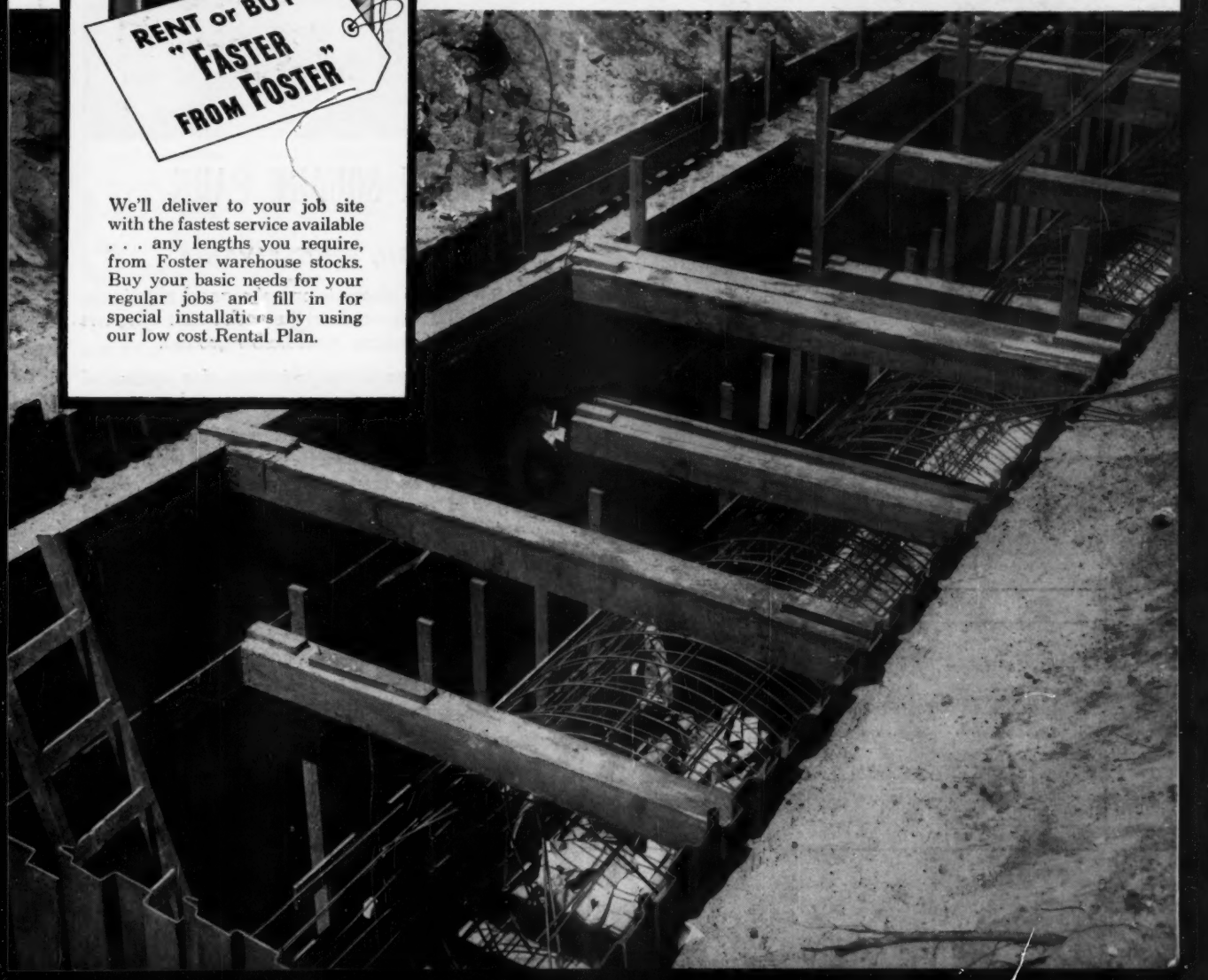

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CIVIL ENGINEERING

APRIL 1957
VOL. 27 • NO. 4

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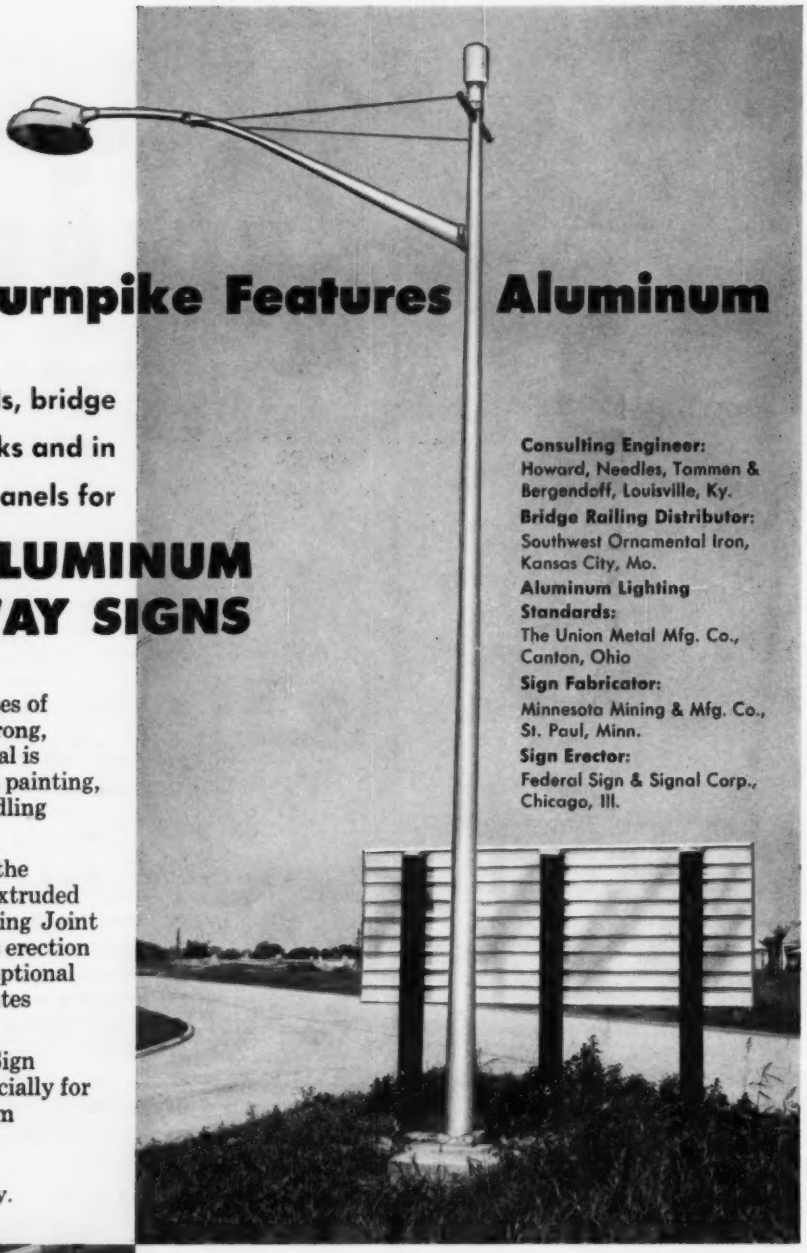

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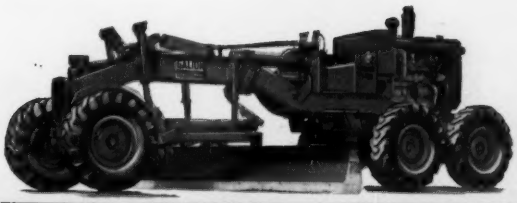

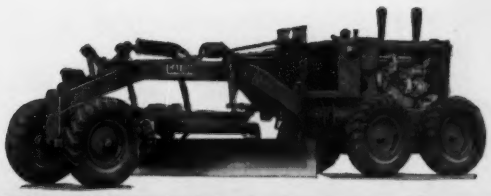

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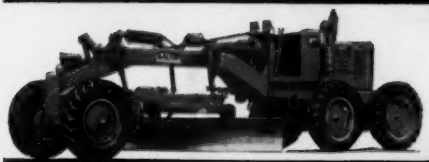

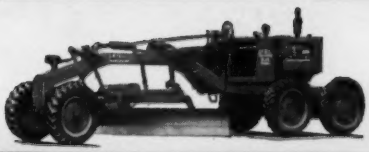

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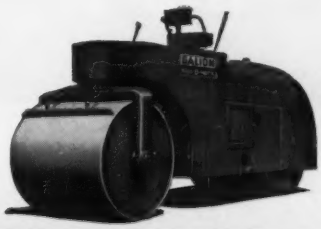

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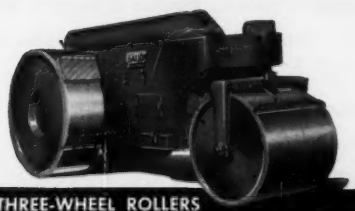

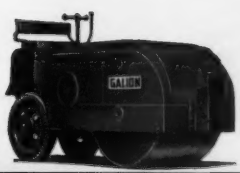

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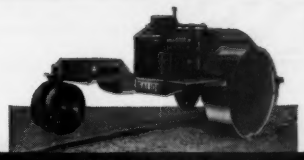

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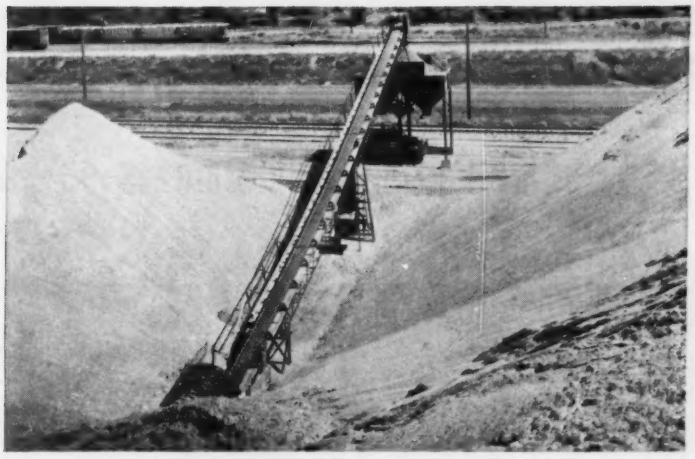

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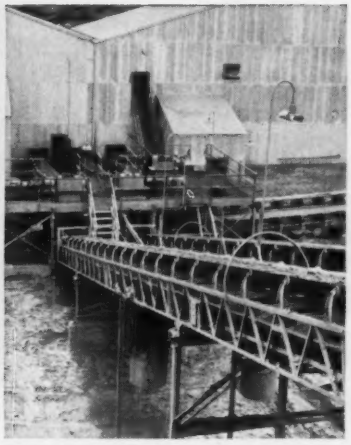

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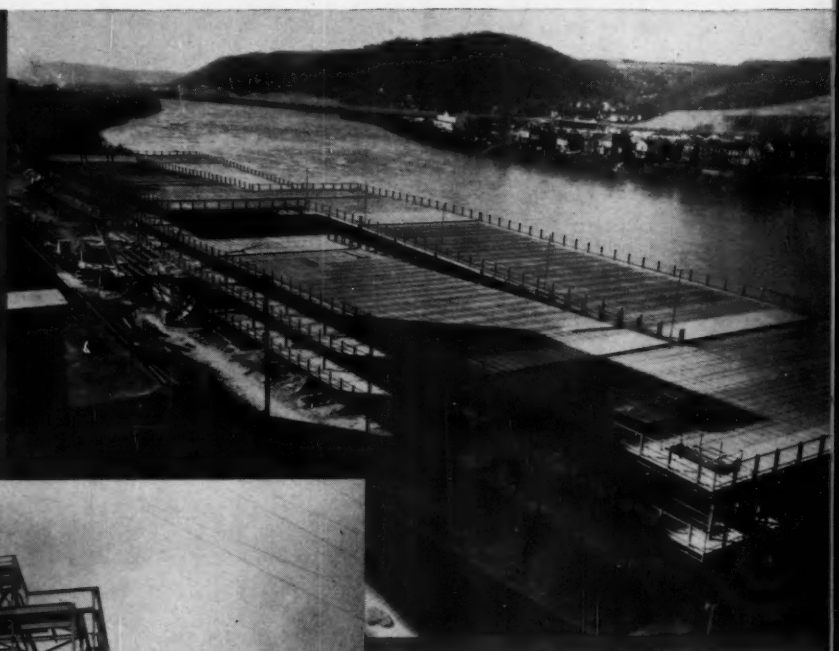

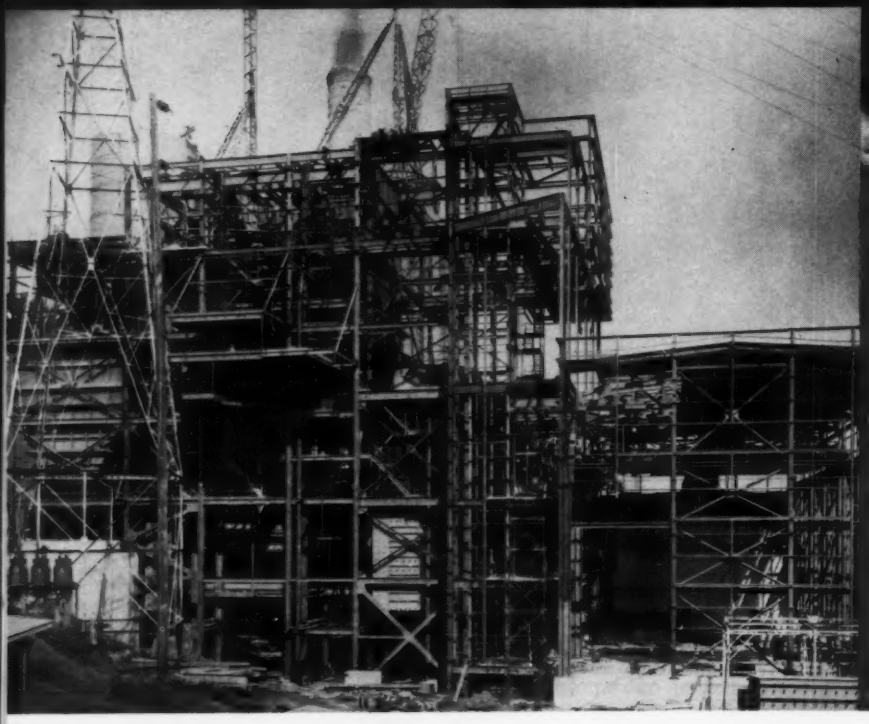

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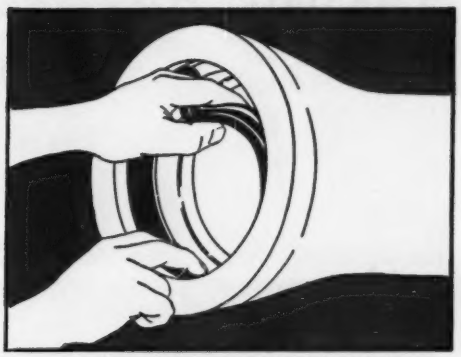
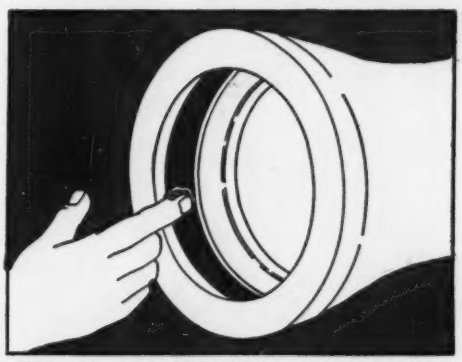
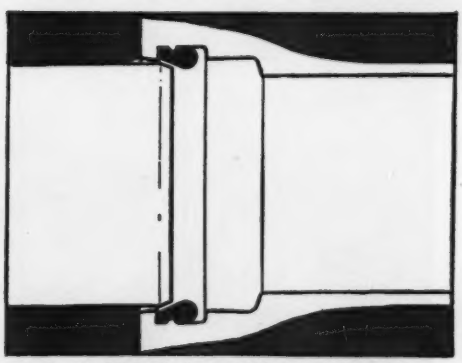


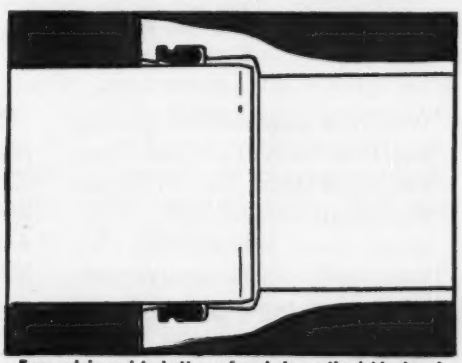
Insert gasket with groove over bead in gasket seat



Wipe a film of special lubricant over inside of gasket



Insert plain end of pipe until it contacts gasket



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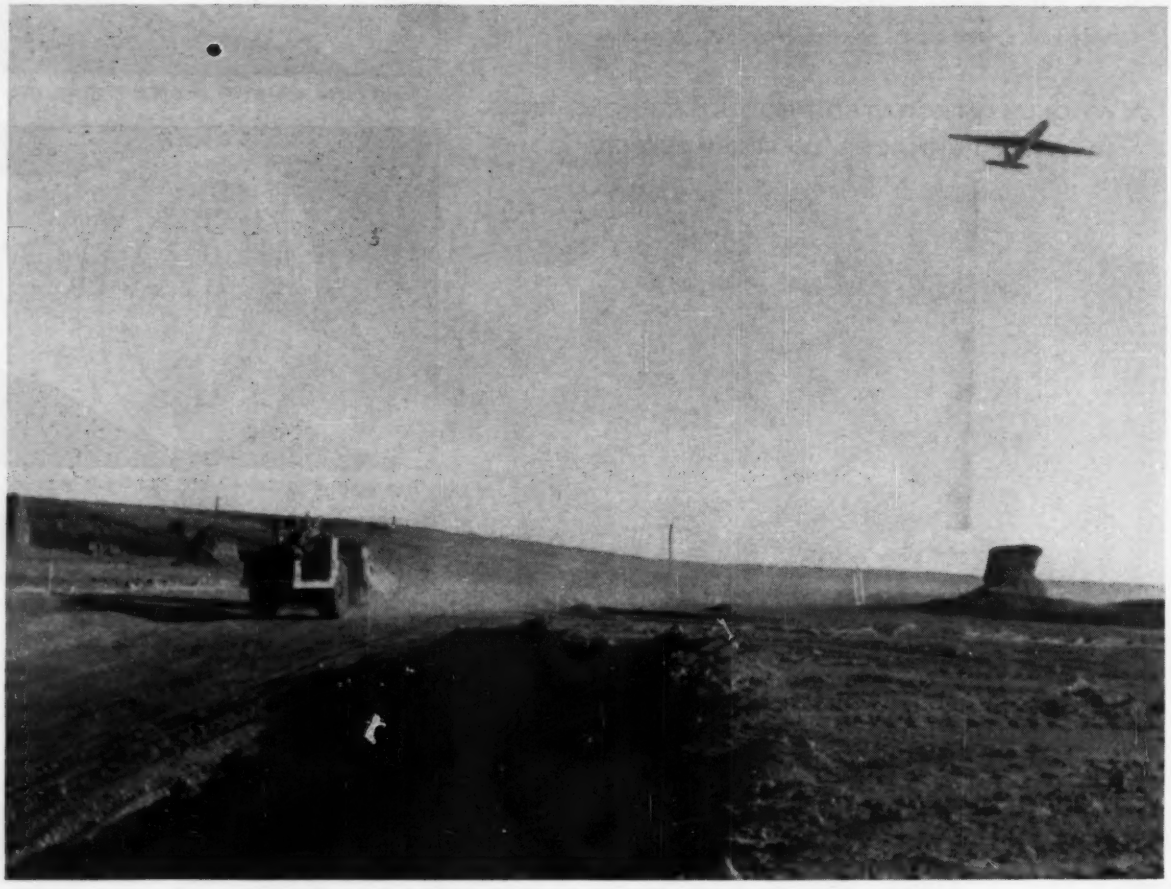
TAKING HAZARDS OUT OF A HILL

$1,259,962 project to provide a safer approach at Ellsworth Air Force Base is speeded to completion with Caterpillar-built equipment

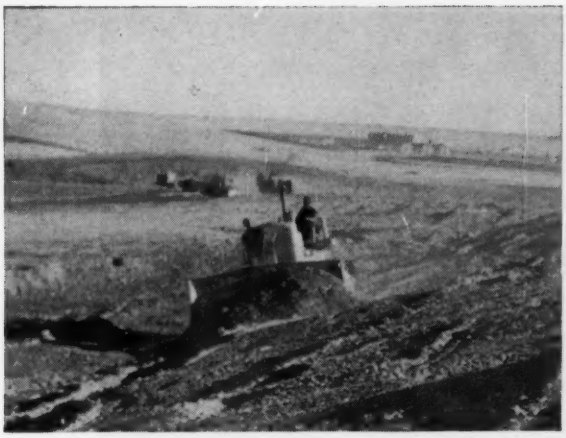


One of twenty Caterpillar-built rubber-tired units engaged in the elimination of a hill at Ellsworth Air Force Base, this two-wheel DW21 Tractor with Scraper speeds glacial till to the waste area.

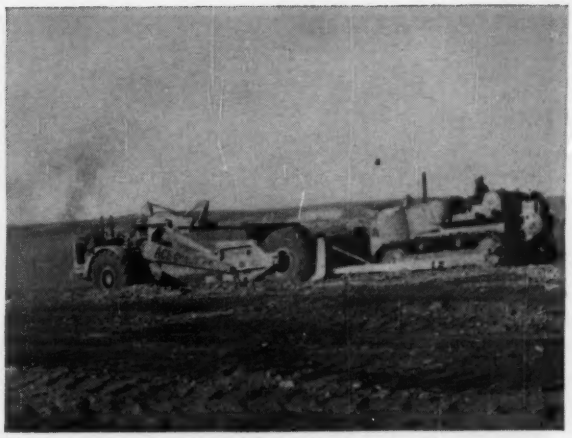
With B52s scheduled for operation from Ellsworth Air Force Base, Rapid City, South Dakota, the NW-SE runway is being extended 3,000 feet. To permit a flatter, safer approach, a hill about a mile from the runway's northwest end is being eliminated. Although not very high, this hill had claimed two aircraft.

The $1,259,962 contract for the approach zone grading was awarded to C. F. Lytle Company, Sioux City, Iowa. It involves moving almost five million yards of glacial till from the hill. This will open a cut 35 feet deep on a maximum of 1.5 to 1 slope to a point 4,500 feet from the end of the runway, then falling off to a 2 to 1 through the remainder of the cut. It fans out from the end of the runway to 3,000-foot width at the end of the cut. The side slopes are trimmed back 7 to 1.

To speed up the work, Lytle subcontracted half the project to Ace Construction Co., Omaha, Nebraska. The center line of the runway was ex-



Besides cleaning up slopes, this D8 is used for utility, 'dozing, spreading fill, etc. It is one of five husky D8s on the job.



Forty seconds for a heaping load is the average loading time in good going for this Cat D9 Tractor pushing a DW21 unit.

A four-wheel Cat DW20 Tractor with Scraper hustles back from a haul over road maintained by a No. 12 Motor Grader.

tended through the cut. Lytle is working the north half; Ace, the south half. Both contractors work two 10-hour shifts per 6-day week. And both rely heavily on rugged yellow machines for high production.

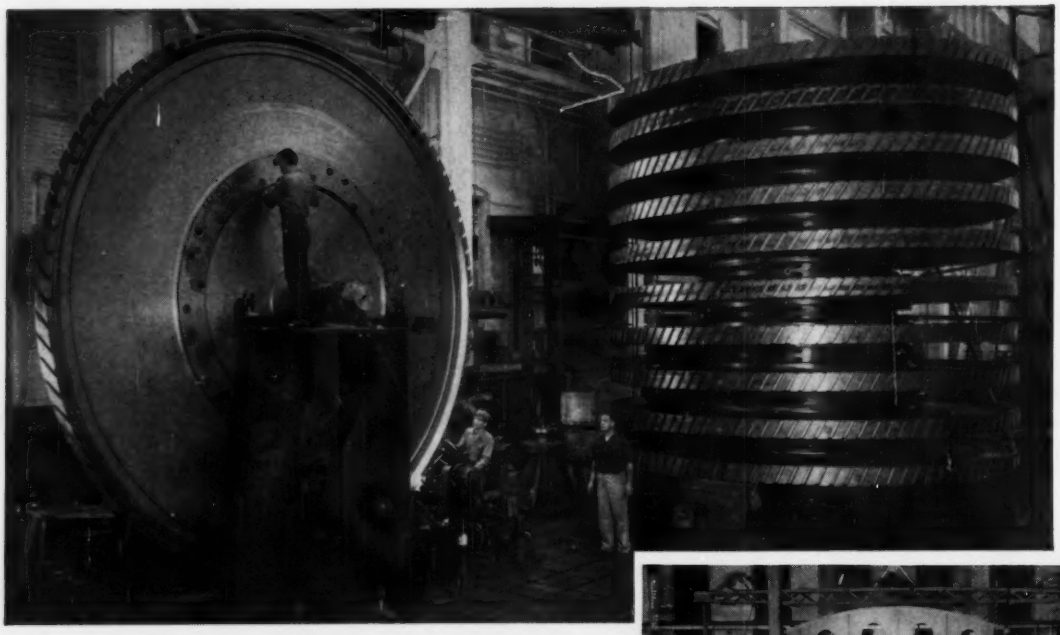
B. D. McMillan, project superintendent for Lytle, has an equipment line-up that includes ten Caterpillar* DW21s with Scrapers, four D8 Tractors and two No. 12 Motor Graders. The DW21s are loaded on a five per cent grade, then speed an average of 2,400 feet in fourth gear to the waste area on the far side of the hill. The waste is spread in one-foot lifts and compacted by the heavy rubber-tired scrapers rolling across it. One D8 is used for push-loading and the other three D8s for sloping, clean-up, spreading fill and pushing when needed. The two No. 12 Motor Graders keep the roads bladed down.

On the south half of the cut, Ace's project superintendent Don Haugan uses five CAT* DW20 and five Cat DW21 Scrapers on an average 2,600-foot haul to the waste area. Three giant D9s push-load the scrapers. Loading times vary with conditions. In good going, a D9 gets a scraper off with a heaping load in 40 seconds. A D8 does utility 'dozing, cleans up slopes, spreads fill and rips with a Cat-built Ripper when the glacial till is too tough to load. A No. 12 Motor Grader maintains the roads.

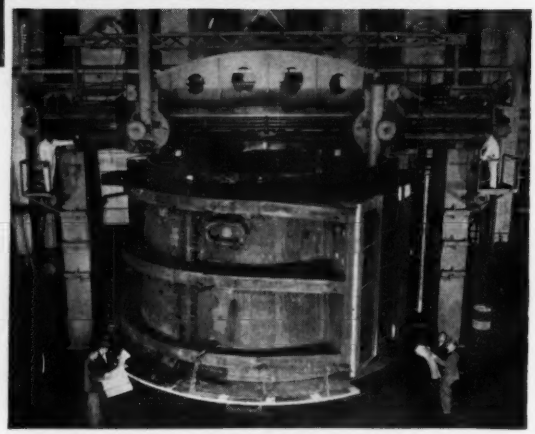
On jobs like this, and on every type of earthmoving, contractors find that standardization on Caterpillar-built machines pays off many ways. Maintenance is simplified. Operator familiarity with similar units results in higher production. The interchangeability of many parts reduces inventory requirements. And "one-stop" service by the nearby Caterpillar Dealer helps lessen down time at lower cost. He's the man to see for complete information about this modern heavy-duty, job-tested equipment.

CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS, U. S. A.

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.



Rotor discs for mammoth 11-stage compressor were balanced and stacked for alignment in one of Newport News' five huge machine shops. Large engineering and technical staffs with a vast plant make Newport News an ideal source for large equipment . . . *standard or special in design.*



A 35-foot boring mill in Newport News' plant machining the 374,000-pound upstream housing for the giant axial flow compressor. The compressor is heart of an 8-foot supersonic wind tunnel at the Ames Aeronautical Laboratory of the National Advisory Committee for Aeronautics at Moffett Field, Calif.

To create winds exceeding

2000 MPH

Newport News builds world's Mightiest Compressor

Whenever you want large units built with careful attention to detail, give the job to Newport News.

This company recently built an eleven-stage axial flow compressor that shatters all previous records for wind force . . . using what is believed to be the world's largest rotating object.

The rotor, weighing more than 400 tons, comprises eleven huge discs. Each disc, machined from a 96,000-pound forging, was finished to a 50,000-pound wheel and balanced to within 26 ounces at the rim. In each rim, slots for blades were machined to within .005″ on special milling heads designed and produced in the Newport News plant.

Here at Newport News, you'll find more than large productive capacity. In machine shops, foundries and forging plants Newport News craftsmen complete your orders with specialized techniques backed by experience in fabricating thousands of products.

Newport News' craftsmen produce units that range from small components of spinning machines, to mammoth hydraulic turbines . . . from piping, pumps and valves, to vacuum tanks, digesters and bridge caissons.

These skilled men handle the job exactly as you want it done, for maximum results per dollar invested. So let us bid on your present or future projects. Learn how Newport News can help you. Send for our illustrated booklet entitled, "Facilities and products" . . . it's your for the asking.

Newport News

Shipbuilding and Dry Dock Company

Newport News, Virginia

Facts you can really get your teeth into

Roebling Bulletin PC-932 is designed to show what is being done and can be done with prestressed concrete members.

One section is devoted to the details and operation of casting beds. Another section gives engineering data for tensioning strands.

Rather than tell you *all* about it, we would prefer to send you a copy. You can use the coupon or write to Construction Materials Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

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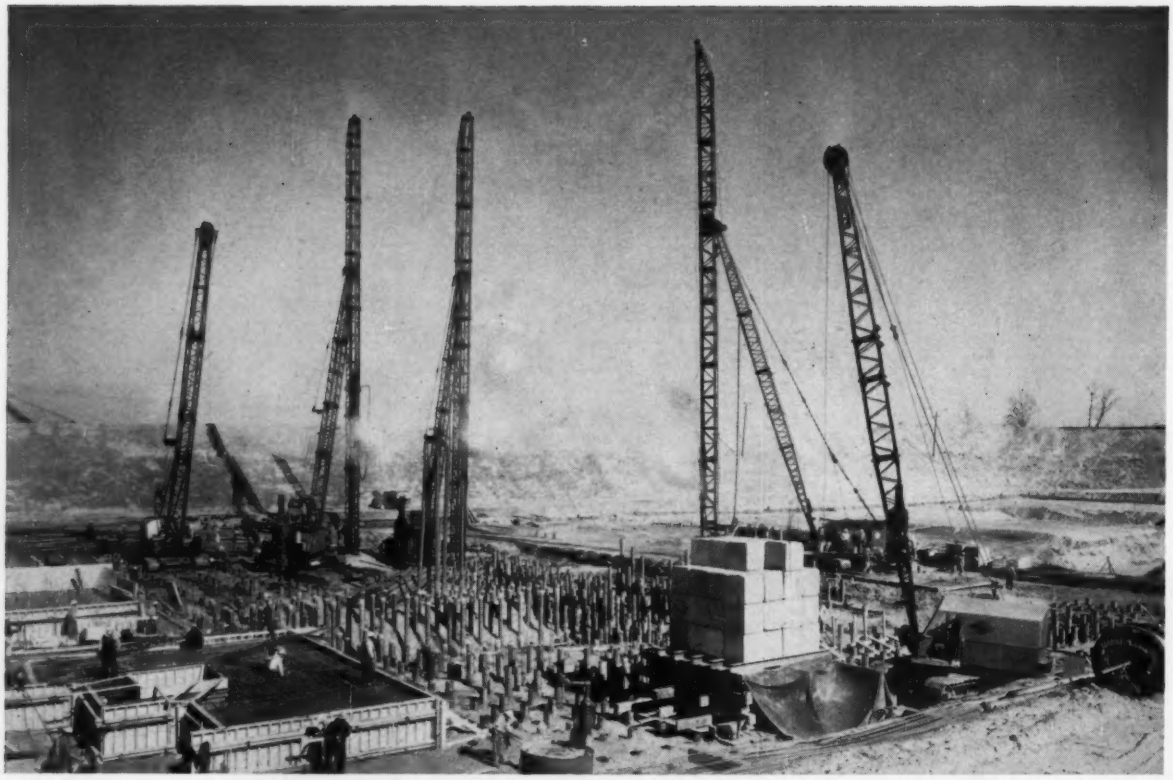

At Memphis, Tennessee

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6,254 Cobi Cast-in-Place Concrete Piles

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Owner: Memphis Gas, Light and Water Division, City of Memphis
General Contractor: J. A. Jones Const. Co., Nashville, Tenn.
Piling Subcontractor: C. L. Guild Construction Co., Inc.
East Providence, Rhode Island
Engineers: Burns & Roe, Inc., New York City
Piling: 6,254 Cobi Cast-in-Place Concrete Piles. Estimated total lineal feet: 335,000.

Call Guild for estimates on ANY TYPE of piling job ANYWHERE in the Country.

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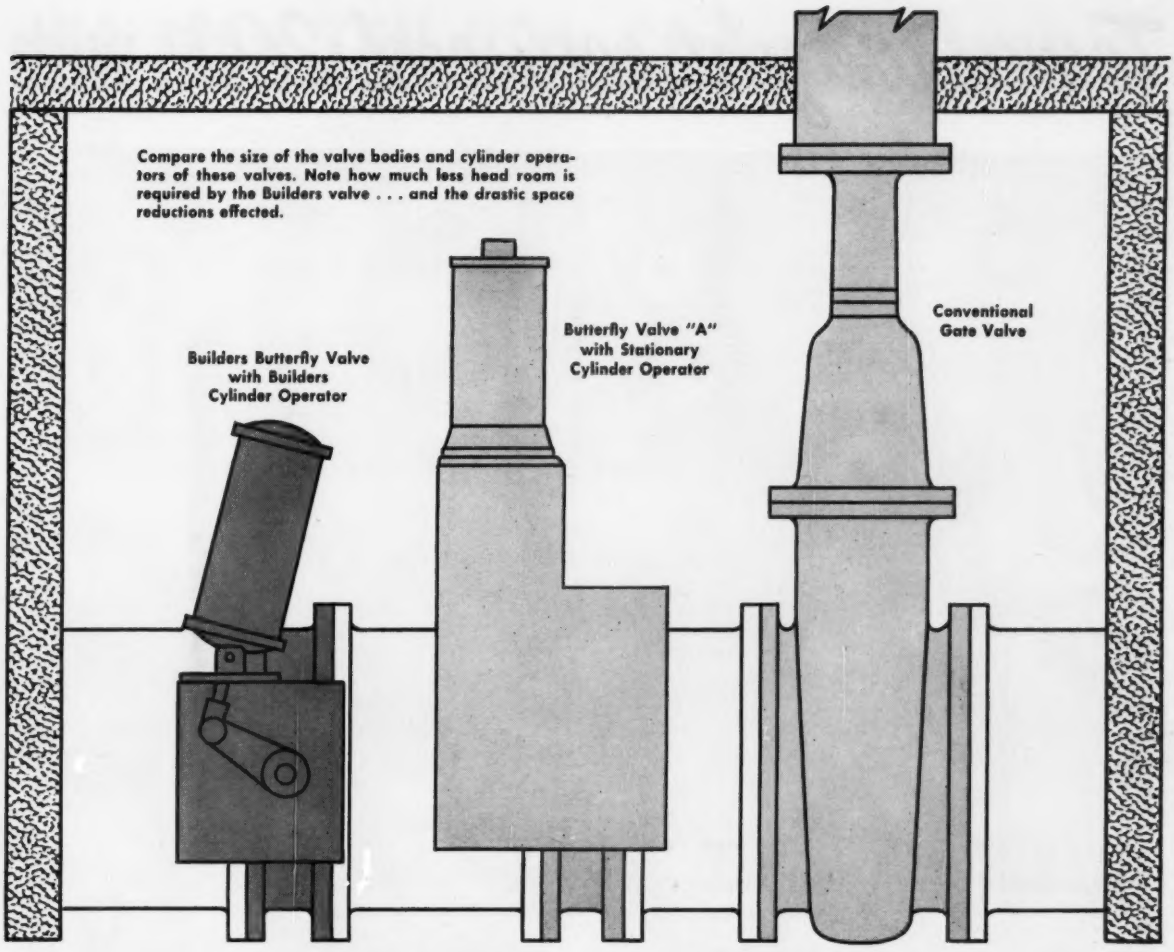
SYRACUSE, NEW YORK NEW YORK, N. Y. KANSAS CITY, MO.


Compare the size of the valve bodies and cylinder operators of these valves. Note how much less head room is required by the Builders valve . . . and the drastic space reductions effected.
Builders Butterfly Valve with Builders Cylinder Operator
Butterfly Valve "A" with Stationary Cylinder Operator
Conventional Gate Valve

CUT CONSTRUCTION COSTS . . .

with compact Builders Butterfly Valves!

Construction costs of pipe galleries can be reduced by using space-conserving Builders Butterfly Valves. Because these valves and their customized operators have small overall dimensions, they can be installed in the tightest piping layouts. This reduces the size of the galleries housing them, eliminates the need for special construction and supports, and effects savings in both construction materials and labor. For the ultimate in installation convenience and application adaptability, request complete data on Builders "more-for-your-money" valves that easily meet (and surpass) all AWWA Specifications. Designed for water works and sewage service . . . made by the leading specialized supplier of water works and sewage equipment.

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BUILDERS-PROVIDENCE
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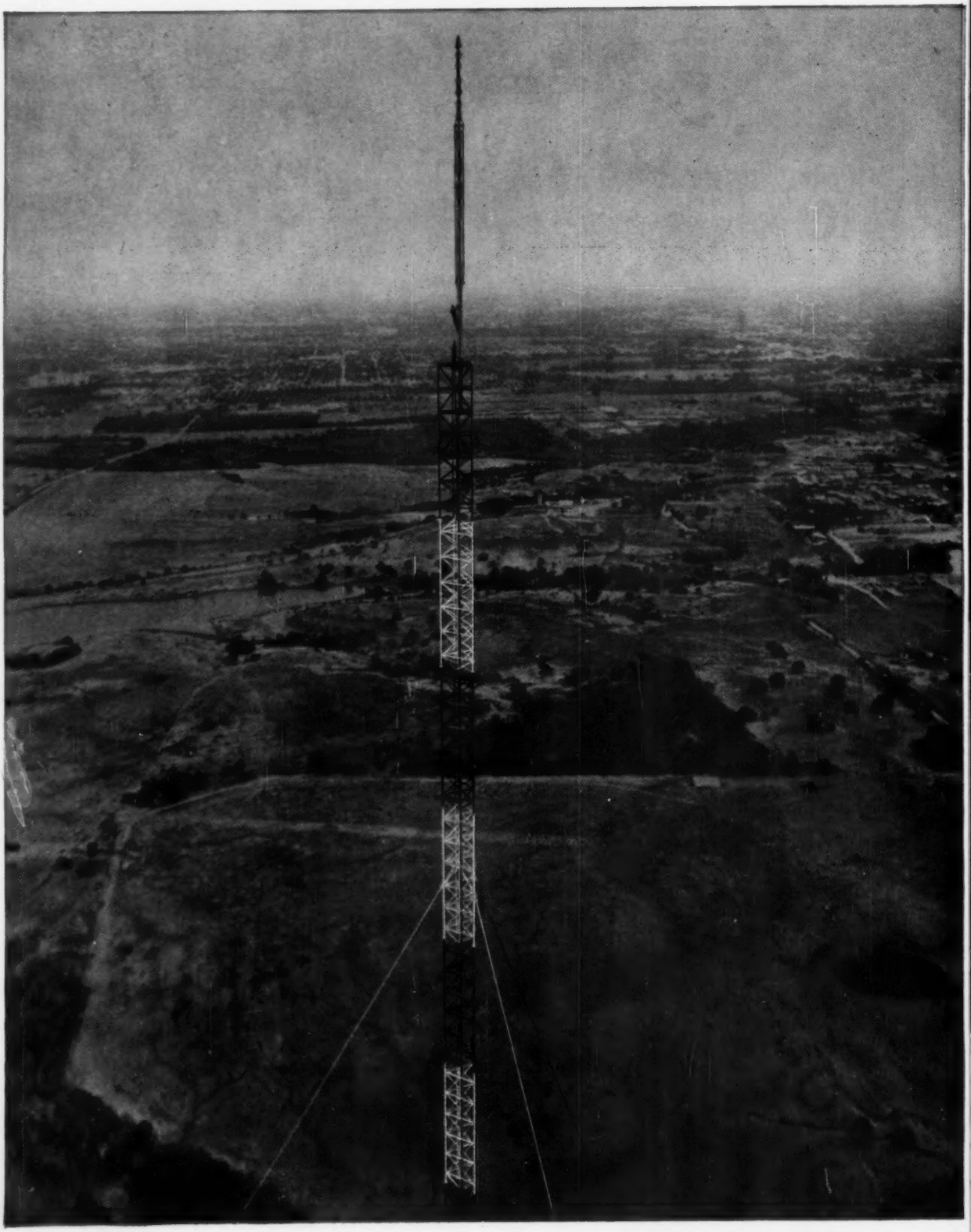
Tower weight reduced 20% with



USS MAN-TEN High Strength Steel

1078 ft. high, this television tower of Station KFJZ at Fort Worth, Texas, is designed to carry a 74-ft. VHF antenna weighing 10,000 lbs. and to resist winds up to 110 miles per hour.

TO PROVIDE THE STRENGTH needed and at the same time to keep tower weight low, round bars of USS MAN-TEN High Strength Steel were used in the tower legs.

This construction has two principal advantages. First, the round leg sections have only two-thirds the wind resistance of flat or angular sections. Second, because MAN-TEN Steel is one and a half times stronger than structural carbon steel, it can be used in smaller diameters for a given strength level. Thus, by using MAN-TEN Steel rounds, the tower could be designed lighter and still meet the wind resistance requirements.

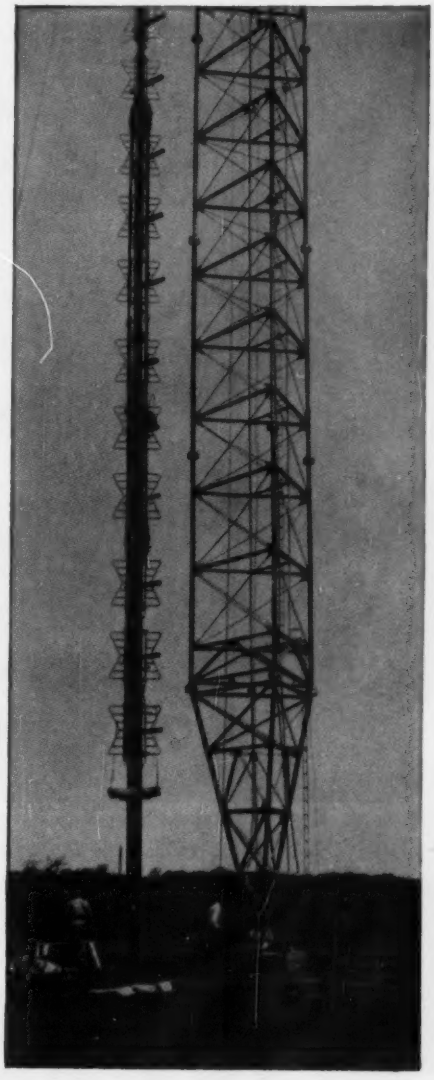
Actually the USS MAN-TEN Steel legs are about 17 to 20% lighter—and thus are substantially smaller in diameter—than A-7 carbon steel legs would be. The resultant decrease in wind load made it possible also to decrease the size and weight of struts and bracing, thus further reducing the weight of the tower proper and making the use of smaller piers and lighter guys feasible.

So even though MAN-TEN Steel was used in only the tower legs, it resulted in a reduction in over-all tower weight of about 20%—from about 150 tons to 120 tons.

In all, 65 tons of USS MAN-TEN Steel are used in the legs. These range in diameter from 5 in. at the tower base to 3 in. at the top and were fabricated by Parkersburg Rig and Reel Company. The mild steel splice plates and intermediate gusset plates for bracing members were attached by jig welding. Bracing and struts were bolted to the legs in the field where the leg sections were assembled and erected.

This application is typical in that it illustrates how USS MAN-TEN and other USS High Strength Steels—USS TRI-TEN "E" and USS COR-TEN—are being used by structural engineers and bridge designers to build safer, more dependable and more durable structures—often at lower cost.

Our engineers will be glad to discuss the many advantages of High Strength Steel construction and give you the benefit of their long experience in applying these superior steels to your designs.



Tower was designed and fabricated by The Parkersburg Rig and Reel Company of Fort Worth, Texas and was erected by Beasley Construction Company, Muskogee, Oklahoma.

USS HIGH STRENGTH STEELS

UNITED STATES STEEL CORPORATION, PITTSBURGH • AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO • NATIONAL TUBE DIVISION, PITTSBURGH
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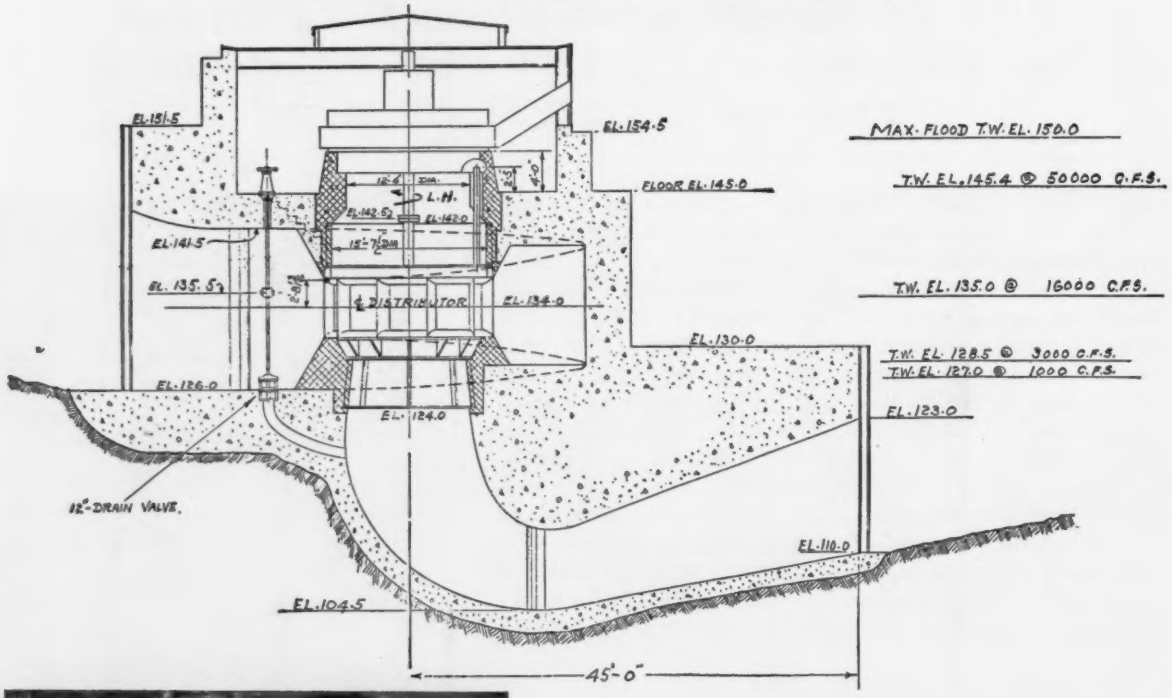
UNITED STATES STEEL

at the Central Maine Power Company's Bar Mills Station

Two Leffel Turbines Help Boost Power Output By 150%



An increase in annual output from 8,500,000 KW hours to 21,000,000 KW hours is expected by the Central Maine Power Company as a result of the recently completed rebuilding of their Bar Mills Hydroelectric Station. Two Leffel turbines—replacing four smaller turbines installed in 1919—play a major role in the Bar Mills redevelopment.

Each of the turbines is rated to develop 3,000 HP at 120 RPM under a twenty foot net effective head. The turbines, of the fixed-blade propeller type, are installed in concrete spiral casings and mounted on curved concrete elbow draft tubes.

The top view at the left shows the completed power plant and dam; the bottom view shows the installation of the turbine stay ring and pit liner in the concrete spiral casing.

Here and throughout the world, Leffel turbines are economically and efficiently harnessing water power. Before you plan any future turbine installation, get the facts on efficient, reliable Leffel turbines tailored to meet all your hydroelectric power requirements. Write today for complete information.

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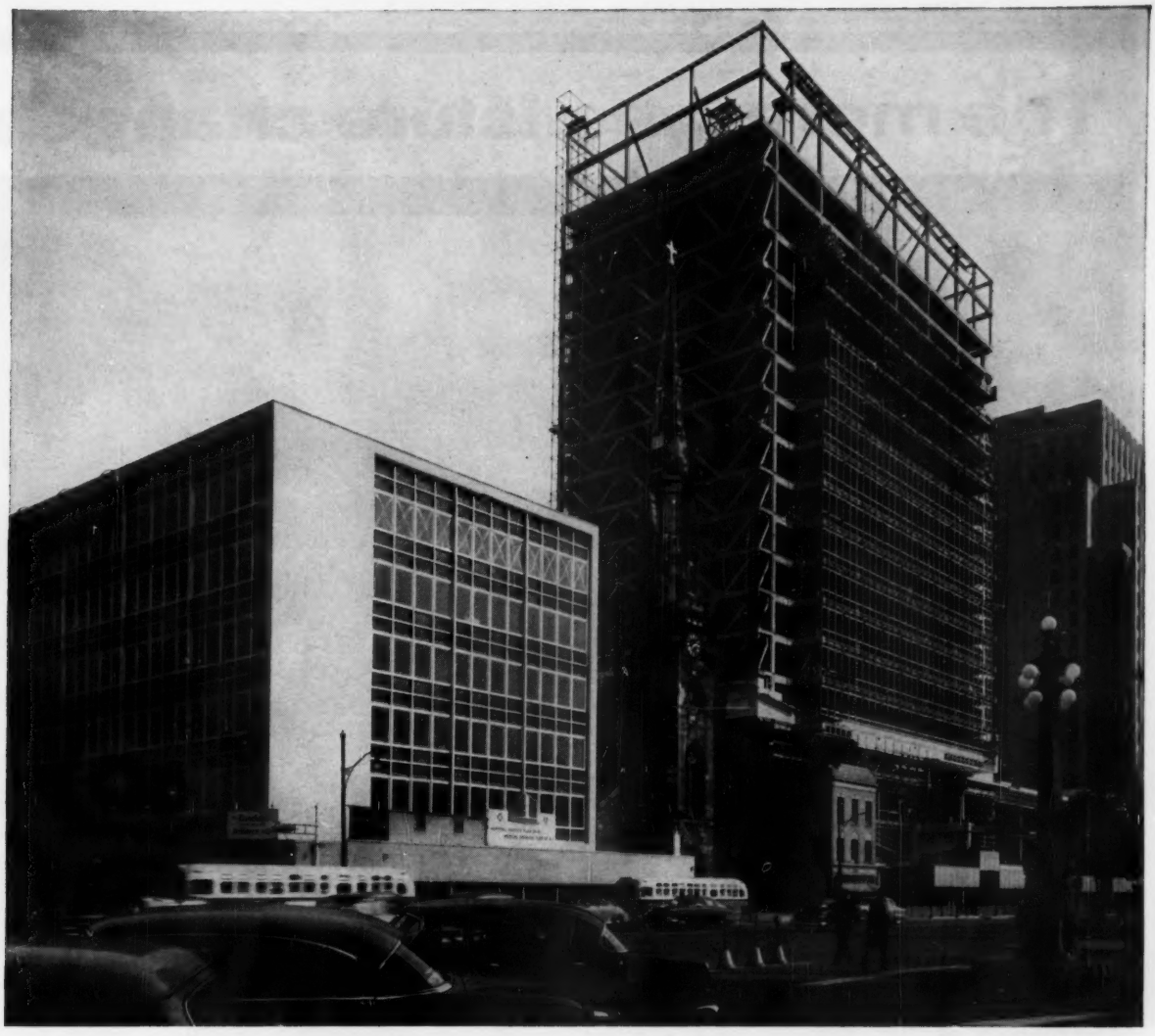

Big Doings in Newark

Newcomers to the Washington Park area of Newark, N. J., are these buildings of The Mutual Benefit Life Insurance Company. The six-story building, photographed when nearly ready for occupancy, has been leased to the Hospital Service Plan of N. J. The twenty-story structure is to be Mutual Benefit's new home-office building.

Both of these two buildings were fabricated and erected by Bethlehem, using high-strength structural bolts for field connections.

As shown in the accompanying rendering, the front of the office tower is to be of metal-and-glass panel construction. Gleaming white limestone frames the blue-green facade and covers the windowless north and south end walls. The truss-type bracing shown above will support the stone facing.

For the home office building—architect: Eggers & Higgins; structural engineer: Weiskopf & Pickworth; mechanical engineer: Syska & Hennessy; general contractor: George A. Fuller Co.

For the Hospital Service Plan building—architect: Frank Grad & Sons; consulting architect: Eggers & Higgins; structural engineer: Weiskopf & Pickworth; mechanical engineer: Seeyle, Stevenson, Value & Knecht; general contractor: W. L. Blanchard & Co.

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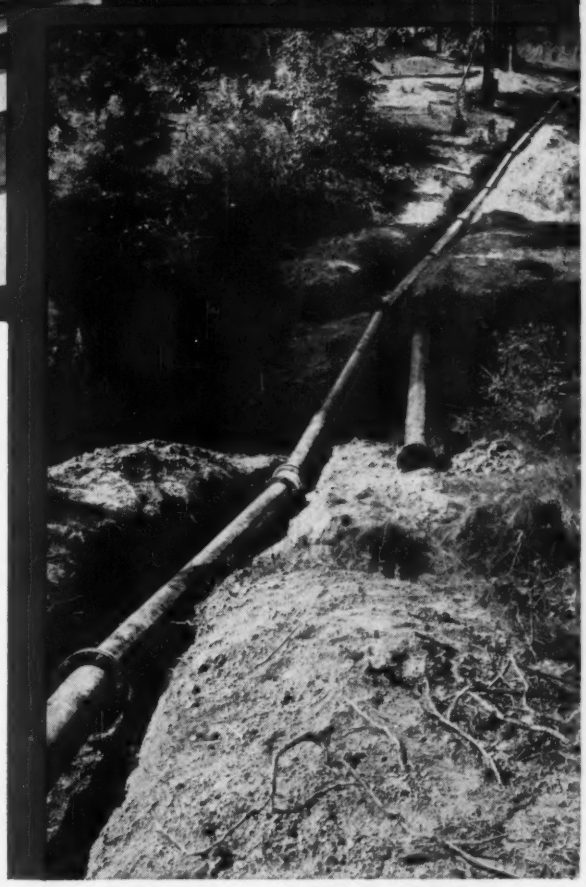
Our American water picture has changed drastically since the first cast iron pipe was laid over a century ago. Today, 44 public utilities in the United States and Canada still use cast iron water mains installed 100 and more years ago! *Modernized* cast iron pipe, centrifugally cast, is even tougher, stronger, more durable. Even more efficient than the cast iron pipe whose unique record for longevity has remained unchallenged through a century of technological progress.

Two of four parallel lines of 10" Mechanical Ball Joint cast iron pipe being installed across Mobile River, Ala.

CAST IRON PIPE

the more it is the same

Cast iron pipe to be installed for sewers and other services at industrial plant at Bellwood, Ill.



More than a mile of cement-lined, seal coated Mechanical Joint cast iron pipe carrying mine water for coal company at Sumiton, Ala.

CAST IRON

Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 122 So. Michigan Ave., Chicago 3, Ill.

SERVES FOR CENTURIES...

NEWS OF ENGINEERS

A. Andrew Boemi has resigned as vice-president of the First Federal Savings and Loan Association of Chicago to become president and member of the board of directors of the Madison Bank and Trust Company, Chicago. He is expected to take an active part in the redeveloping of one of the large downtown business areas in Chicago.

Myron Hendee, formerly chief land planning consultant with the Federal Housing Administration and recently chief of the Planning and Engineering Division, District of Columbia Redevelopment Land Agency, has been appointed chief of the Planning Section in the United States Post Office Department, Washington, D. C.

Robert B. Neighbor, of Portland, Ore., has been promoted from Second to First Lieutenant at the Ordnance Guided Missile School, Huntsville, Ala. A graduate of Stanford University and Oregon State College, Mr. Neighbor entered the service in 1955 and at the present time is project officer, Planning Branch, in the Operations Division of the school.

Francis E. Twiss, former director of engineering of the International Road Federation, has been appointed engineering adviser to the Associated General Contractors of America, Washington, D. C. Mr. Twiss will be in charge of the AGC's cooperative work with ASCE and the American Society of Engineering Education and maintain relations with highway associations in Washington. In addition he will work closely with the manager of the Highway Division in providing service for its members.

Francis E. Twiss

Kenneth C. Cox, chief engineer of Dravo of Canada since 1953, has been appointed to the newly created position of manager and chief engineer. Mr. Cox joined Dravo in 1939 and is a member of the board of directors of Dravo of Canada and served three terms on the Dravo Corporation junior board of directors.

J. F. Brookes, professor of civil engineering at the University of Oklahoma, was recently honored with a $500 award from the Oklahoma University Foundation for "extraordinary excellence in student counseling and teaching of freshmen and sophomores." Professor Brookes has been on the civil engineering faculty since 1921. In December he was honored at an Oklahoma Section meeting on attaining life member status in the Society.

Stephen M. Olko announces the opening of a consulting practice, specializing in foundations, portworks, highways, airfields and structures, with offices at 50 East 42nd St., New York 17, N. Y. Mr. Olko was formerly chief port engineer, AESB in Madrid, Spain, and project manager for F. R. Harris Inc., consulting engineers, New York City.

William R. Mason has been promoted to the post of chief engineer of Arcadia Metal Products at Fullerton, Calif. Prior to joining the firm a year ago as production engineer, Mr. Mason was divisional director of the amphibious construction division of the U. S. Naval Civil Engineering Research & Evaluation Laboratory at Port Hueneme.

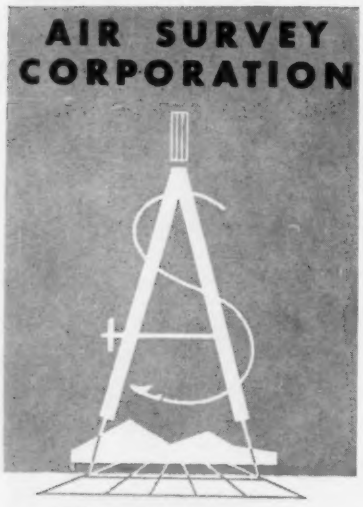
Leo H. Corning, until recently director of Promotion Planning and Engineering Services for the Portland Cement Association, Chicago, has been named to the newly created position of chief consulting structural engineer. In his new position, he will serve as the association's leading authority in the field of structural engineering and as senior adviser in other fields of engineering. Mr. Corning has been with Portland Cement since 1929.

The Harza Engineering Company, Chicago, Ill., consulting engineers specializing in hydroelectric plants and dams, has designated twelve engineers as Associates: **J. W. Dixon,** chief hydraulic engineer; **Andrew Eberhardt,** chief civil engineer; **Donald P. Roberts,** project manager; **Bruce M. Johnson,** project manager and civil department head; **Franklyn C. Rogers,** project manager and civil department head; **Kenneth E. Sorensen,** project manager and planning department head; **Chester E. Bauman,** chief electrical engineer; **Thaddeus Zowski,** chief mechanical engineer; **Clifford L. Willis,** chief geologist; **E. Pierpont Graham,** electrical department head; **George B. Schroyer,** mechanical department head; and **Erik Rettig,** resident manager.

A. M. Anderson, for the past five years executive secretary and chief engineer of the Niagara Frontier State Park Commission, Niagara Falls, N. Y., has become associated with the consulting engineering firm of William H. Byrne, New York City, N. Y. Mr. Anderson will manage the city planning and highway division, act as liaison officer with governmental agencies, and supervise civil engineering studies.

Otaker Ondra, member of the Manhattan College faculty for the past 16 years, has been appointed full professor of civil engineering. Dr. Ondra has been associate professor since 1953. He is the co-author of *Investigation of the Applicability and Limitations of the Various Methods of Computing Amplitudes of Torsional Vibrations in Which Engine Damping Is of Primary Importance.*

Gordon L. Burt, former president of the Oregon Section, was elected secretary-treasurer of the Oregon Technical Council on January 30. **Thane E. Brown** has been appointed by the Oregon Section Board of Directors to serve as representative on the Council for a three-year term, succeeding **Ramon M. Schwegler. Robert M. Bonney,** immediate past-president of the Oregon Section, is the other ASCE representative this year.



Photogrammetric Engineering

Advances starting time.

Conserves engineering manpower.

Produces fast but factual data.

Is economical but exact.

1101 LEE HIGHWAY, ARLINGTON 9, VIRGINIA

Marvin T. Rowland, former district manager with the Layne Texas Co., Inc., Midland, Tex., announces the opening of a practice as ground water consultant. His office is located at 221 South Colorado, Midland, Tex.

Harold Cladny was elected president of the Master Builders' Association, a chapter of the Associated General Contractors of America, at its recent annual meeting held at the Mayflower Hotel in Washington, D. C. Mr. Cladny is the secretary of the M. Cladny Construction Company, Inc., of Washington.

Joseph P. Collopy, after a number of years' experience in land development and project operation and maintenance with the Bureau of Reclamation, has resigned to devote his time to the soil treatment work being carried on by the Collopy Electro-Soil Company of Phoenix, Ariz. This company was recently formed for commercial development of electrical soil treatment processes perfected by Mr. Collopy.

Paul Rogers, consulting engineer of Chicago and secretary of the Illinois Section of ASCE, was recently honored with a Design Award Citation given by the Progressive Architecture magazine in association with Hausner and Macsai, Chicago architects. The award represents recognition for the design of the Columbia and Pratt Apartments in Chicago, said to be "outstanding architecturally, and to have unusual features structurally." Mr. Rogers is the holder of several awards, including the Society's J. James R. Croes Medal.

Meyer S. Bogost, special assistant for sanitary engineering to the District Public Works Officer, 14th Naval District at Pearl Harbor, has become connected with Robert A. Anderson (hydraulic engineer), Gene Drane (electrical and fire protection engineer) and John Lum (mechanical draftsman) in engineering practice. The firm name will be Consulting Engineers of Hawaii, with offices in Honolulu.

J. Stephen Watkins, consulting engineers of Lexington, Ky., announce the opening of an office at 533 North Clippert St., Lansing, Mich., under the resident direction of **Robert H. Uhl.** Mr. Uhl formerly held the position of office engineer in the Valparaiso, Ind., office.

Lyall A. Pardee, who has been acting as city engineer of Los Angeles for more than a year, has been given a permanent appointment to the post by the Board of Public Works. He was chosen after he topped others in Civil Service examinations. Mr. Pardee has been in the Los Angeles Bureau of Engineering for 33 years.

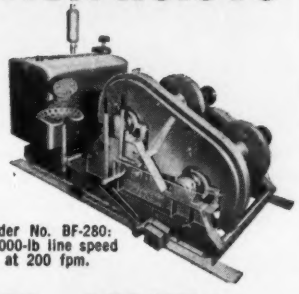
Ralph N. Brescia, until recently director and manager of the Maintenance Engineering Division of the Navy Department of Public Works, Third District, is now associated with the Army Corps of Engineers, as chief of the Construction Engineering Branch, on the construction of facilities at the Thule Air Force Base. Mr. Brescia's address is Area Engineer, E. O. D., A.P.O. 23, New York, N. Y.

John M. Henderson, deputy chief of the Technical Development Laboratories of the U. S. Department of Health, Education, and Welfare at Savannah, Ga., has been in India since January as the engineer member of a three-man international team of malariologists requested by the Government of India to evaluate its national malaria control program. The India program is the world's largest, with the objective of controlling 80 million cases among 200 million people in malarious areas.

(Continued on page 26)

Electric, Gas or Steam Drive
BAND FRICTION HOISTS

- Reversible for wear
- Non-burn lining
- "Face forward" friction and break levers
- Anti-friction bearings

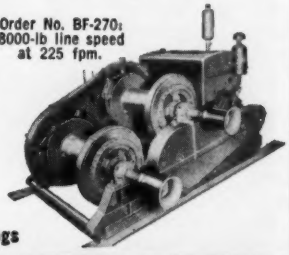


Order No. BF-280: 10,000-lb line speed at 200 fpm.

LIGHT · · · COMPACT · · · RUGGED!

Meet your hoisting needs *precisely* at lowest possible cost. Take advantage of our long experience in modifying and re-combining standard parts to meet individual hoisting requirements.

Order No. BF-270: 8000-lb line speed at 225 fpm.



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TRACING CLOTH

THE BRUNTON* POCKET TRANSIT

IT'S HANDY...
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News of Engineers

(Continued from page 25)

William L. Pugh, for the past ten years chief engineer of the Aluminum Company of Canada Ltd., recently relinquished this post because of ill health, but will retain his connection with the company as consulting engineer. While chief engineer Mr. Pugh was in charge of all engineering and construction work including the big aluminum plant development at Kitimat, B. C.

William J. Valentine, Commander, U. S. Navy and Deputy District Public Works Officer for the 12th Naval District, San Bruno, Calif., was recently elected president of the San Francisco Post of the Society of American Military Engineers.

Francis E. Jenkins, of Dewittville, N. Y., has been appointed a full-time instructor of engineering and technical courses at Jamestown Community College. He was formerly associated with the D. W. Winkelman Company of Syracuse as civil engineer. Mr. Jenkins is a graduate of the University of Michigan and has done graduate work at the University of Buffalo.

James S. Sweet is now consulting hydraulic engineer with the **U. S.** Operations Mission, Bogota, Colombia. Mr. Sweet was formerly a hydrologist with the U. S. Weather Bureau, Washington, D. C. His address is c/o USOM, American Embassy, Bogota, Colombia, S. A.

Samuel P. Turnbull, former chief engineer of the Florida State Road Department, who has served as chief turnpike engineer for the past two years, resigned March 1 to become engineer-director of the Florida Road Builders Association, Inc., at Tallahassee. It was under Mr. Turnbull's supervision that the recently opened 110-mile Miami-to-Fort Pierce section of the Sunshine State Parkway was built.

Alfred J. Ryan announces that **Herbert F. Hall, Albert T. Knuckey** and **Damon O. Runyan** are now associated with him in the practice of engineering under the firm name of A. J. Ryan and Associates. The headquarters of the firm is 1340 Glenarm Place, Denver 4, Colo.

Samuel De Moss, retired in January as chief of the civil works section in the engineering division of the Seattle District, after 23 years in the Corps of Engineers. Mr. De Moss started working in the Portland District in 1935 and two years later was transferred to the Seattle District, where he has been until now with the exception of a tour of duty in French Morocco.

George M. Shepard assumed the newly created position of Street and Highway Engineering Coordinator for the City of St. Paul, Minn., on January 1. Mr. Shepard has served the city since 1922, with the exception of four years, as chief engineer of the Department of Public Works. He will be responsible for the coordination of major highways authorized under the Federal Highway Act of 1956. **Arthur W. Tews,** formerly assistant chief engineer, succeeds Mr. Shepard as chief engineer.

H. S. Bovay, Jr., consulting engineers of Houston, Tex., announce the advancement of **William N. Pauley** to partnership in the firm. Mr. Pauley will continue in charge of the firm's Spokane branch office, where a projected pumped storage project from the reservoir behind Chief Joseph Dam on the Columbia River is being developed. Other partners are **Bennett W. Burns, Charles A. Lawler,** and **Richard B. Robertson.**

William N. Pauley

E. S. Willis is now structural engineer with the Mississippi Chemical Corporation, of Yazoo City, Miss. Mr. Willis has been with the company since 1954 and formerly held the position of senior draftsman.

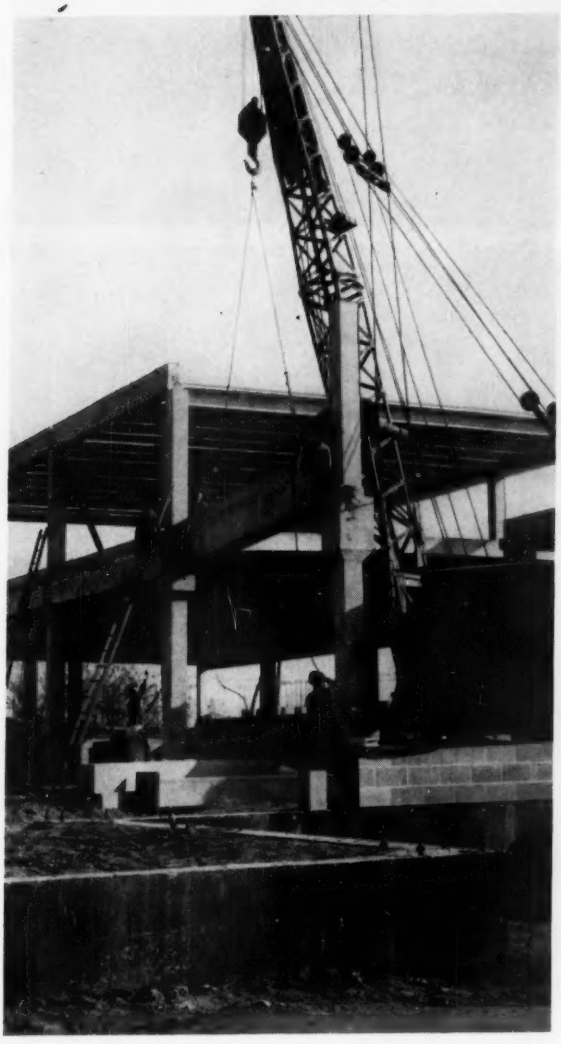
August L. Ahlf is now on the staff of the New York City consulting firm of Tippetts-Abbett-McCarthy-Stratton in Baghdad, Iraq. Until recently a designing engineer for the U. S. Bureau of Reclamation in Bangkok, Thailand, Mr. Ahlf is author of a forthcoming CIVIL ENGINEERING article on the Chao Phya Dam recently completed in that country.

F. T. Sheets, Jr., has been elected vice-president of manufacturing of the Southwestern Portland Cement Company in Los Angeles, Calif. He formerly held the position of director of engineering and operations.

Lloyd J. Williams, Jr., previously structural engineer with the Capital Steel Company, Lincoln, Nebr., has been appointed to the engineering department of the Behlen Manufacturing Company, Columbus, Mo. He will hold the post of structural engineer, working with the manager of the engineering department.

F. A. Dale, consulting engineer of Cashiers, N. C., has returned from a three-month stay in Formosa where he has been consultant to the J. G. White Engineering Corp. on hydroelectric developments under construction and proposed.

Precast concrete frame erected in 9 working days!



Placing prestressed spandrel beam 28′ x 36″ x 18″ at new Albert Godde Bedin, Inc. plant, Depew, N. Y. Precast columns shown are 24′ x 14″ x 14″.

• The entire frame of this industrial plant in Depew, N. Y.—with a total floor area of 25,617 sq. ft.—was erected in *9 working days.*

Such fast work resulted from the use of prestressed concrete beams, floor and roof channels and precast columns, precision made by Frontier Dolomite Concrete Products Corporation, Lockport, N. Y.

IN THE MANUFACTURE OF THESE PRECAST UNITS, Lehigh Early Strength Cement and steam curing were used to achieve maximum production efficiency and economy. The concrete reached 3500 PSI in 12 hours, permitting removal of units and re-use of forms in *less than half the time required with regular portland cement.*

This is typical of the advantages of Lehigh Early Strength Cement in modern concrete construction.

Owner: Albert Godde Bedin, Inc., New York City
Architect: John R. Weber, New York City
Engineer: Freyssinet Company, Inc. New York City
Contractor: George W. Walker & Sons, Inc. Buffalo, N. Y.

- **LEHIGH EARLY STRENGTH CEMENT**
- **LEHIGH MORTAR CEMENT**
- **LEHIGH PORTLAND CEMENT**
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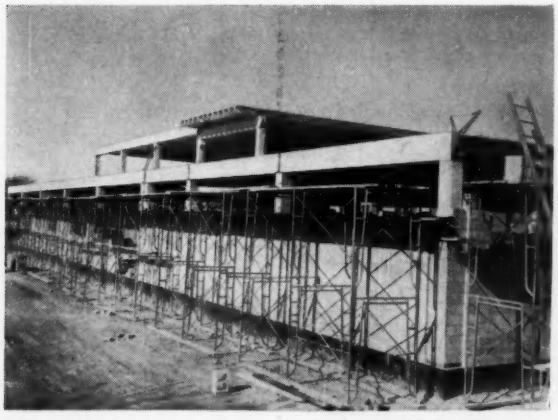
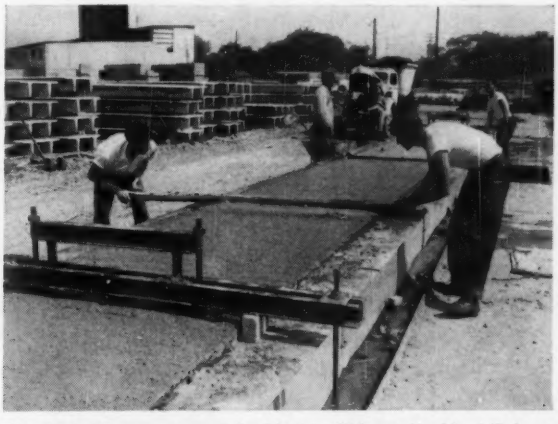
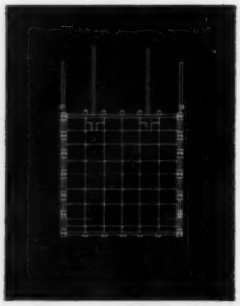
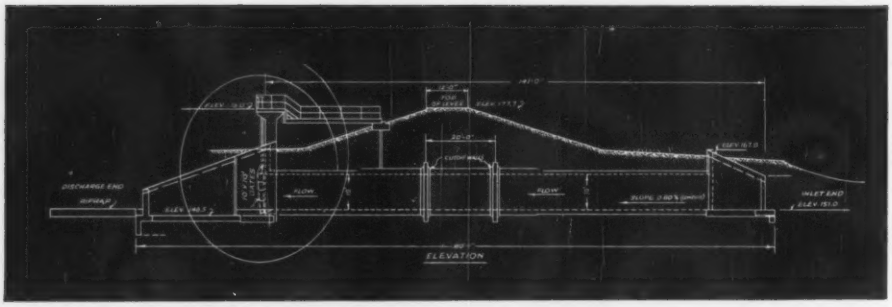


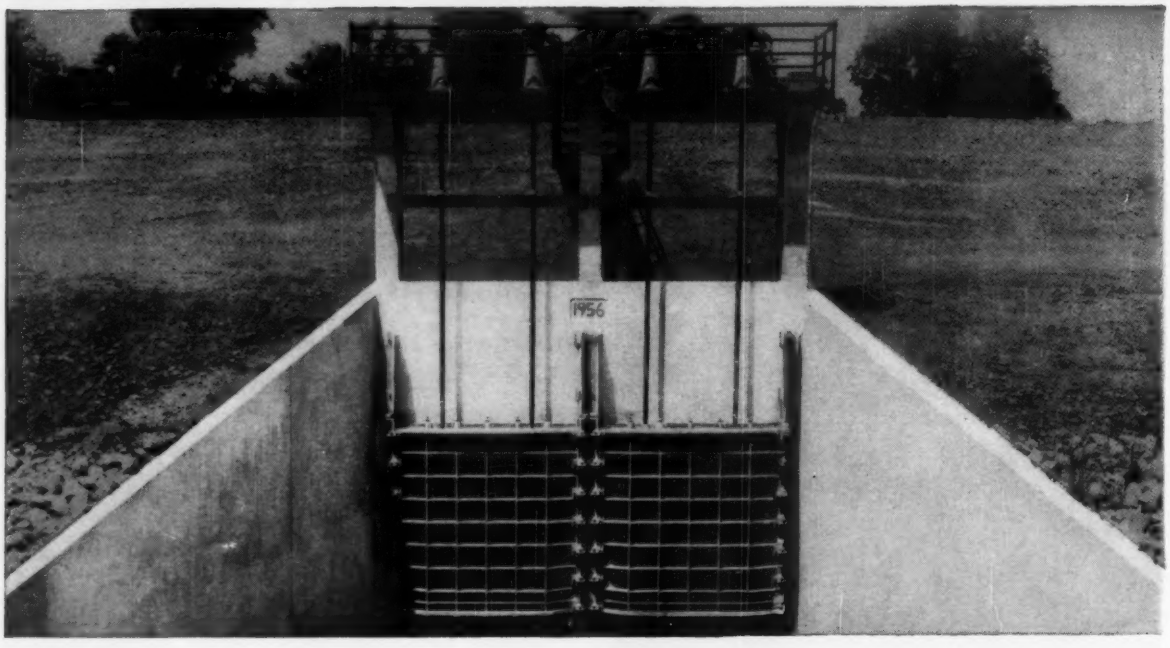
Frontier Dolomite also manufactured the concrete block for the exterior walls. Blocks were made with Lehigh Air-Entraining Cement.



Wood screeding prestressed double tee, 42′ long, 4′ wide, 14″ deep, at Frontier Dolomite plant.







RODNEY HUNT SLUICE GATES ...MAKE THE BAYOU BEHAVE

Water control engineering problems are unique in their profound effect upon human lives, health and prosperity.

In this installation, Rodney Hunt engineering and sluice gate design protect more than 80 square miles of farm land. The gates, when open, allow normal drainage to the Bayou River, and when closed prevent flooding as the river goes to flood stage.

The two Rodney Hunt 10-foot by 10-foot cast iron bronze-mounted sluice gates were designed for maximum opening with minimum structure. The installation is unique because inherently rigid flange frame sluice gates with wall thimbles were installed with attaching studs projecting to the front of the frame. This eliminated the need for excessive side clearance and saved on structural costs. Rodney Hunt also supplied precision-built interconnecting floor stands with twin stems on each gate for balanced, smooth operation.

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. . . . . Am-Soc Briefs

▶ ▶ Beginning with this issue (page 80), ASCE will publish a quarterly Engineering Salary Index. Developed by the Committee on Salaries, the index is intended to supplement the biennial salary survey regularly published by the Society. A great deal of credit is due those members of the Society whose efforts make this useful service possible. Actually two indexes, the ESI is based on consulting salaries and salaries in highway departments. Both these fields are particularly sensitive to prevailing economic pressures in today's engineering employment market.

▶ ▶ A third Joint Cooperative Committee has been authorized by the Board, this one with the AASHO. (The other two with the AGC and AIA.)

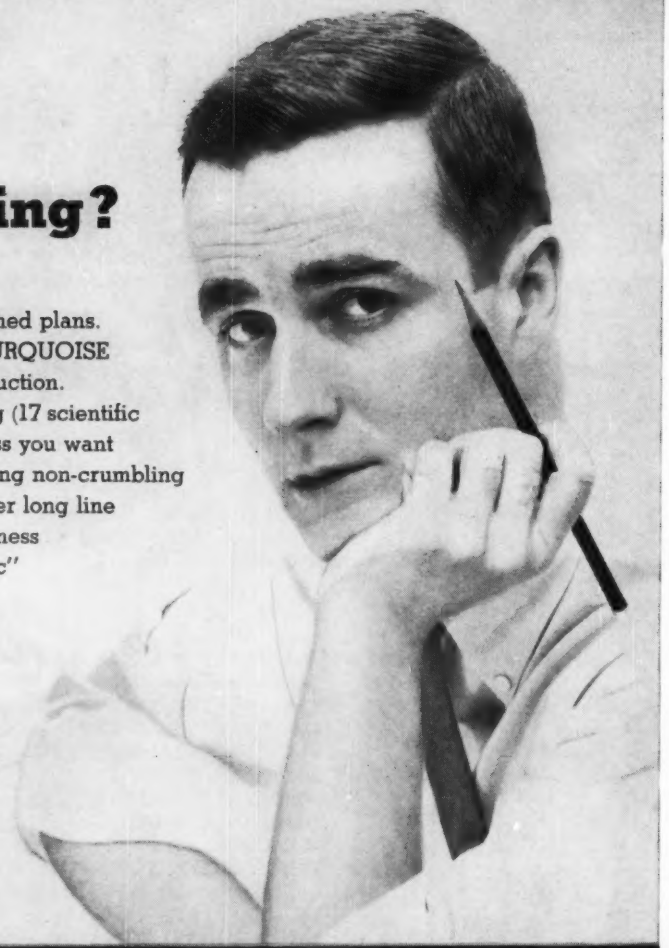
▶ ▶ The Task Committee on Study of Economic Advancement Objectives has come up with a series of recommendations in its interim report that amply fulfill its directive to approach its task in an "aggressive and positive" manner. Its five-point program for immediate objectives (page 77) sets the stage for prompt positive action to "improve the economic status of its (ASCE's) members." Included in the recommendations: a program recommending salary and fee schedules; immediate establishment of representation in Washington; review of present fee curves (in Manual 29); a program to provide, on request, advice and assistance to employers or groups of employees in establishing equitable classification and salary schedules; increase of headquarters staff to accomplish these objectives. With no lost motion, the Board has already approved these recommendations and steps are underway to implement them.

▶ ▶ As compared with a year ago when 488 papers were being processed, the total as of February 1 was 644. Of these, 285 are in various stages leading to publication in "Proceedings," 295 are under review for "Transactions," and 62 are in process for publication in Vol. 122 (1957) of "Transactions."

▶ ▶ Applause department. . . . The Power and Waterways and Harbors Divisions have received letters of commendation from the Board for their "effective development and processing of papers for publication." . . . Similarly commended, the Hawaii Section's wallet-size "Code of Ethics" for all its members.

▶ ▶ Saludos amigos. . . . The welcome mat is out to the new Republic of Colombia Section. Heartiest congratulations to this, the Society's seventy-fifth Local Section. . . . Latest to join the growing list of L. S. Branches is South Carolina's Northwest Branch.

are your **plans** as precise as your **planning?**



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do you know that

Thin arch dams are in high favor in Norway? An analysis of the reasons—climatic, topographic, economic and engineering—for the adoption of this type of hydroelectric power dam is the basis of an interesting article by Norwegian engineer C. F. Groner (page 40).

• • •

Laying out true meridians in defense plants and laboratories can tax the ingenuity of even professional surveyors? The problem—tackled by Prof. Henry F. Soehngen in an article in the May issue—is especially absorbing in view of our continuing defense needs.

• • •

World output of steel broke all records last year? The staggering total of 311 million tons was 17 million tons in excess of the previous record output achieved in 1955. The United States, with its output of 115 million tons, was far in the lead, despite the loss of an estimated 11 million tons during the steel strike. Russia, accounting for about 54 million tons, was the next largest producer, followed by West Germany with nearly 26 million tons; Great Britain with 23 million tons; France with about 15 million tons; and Japan with 12 million tons. Source of these figures is the American Iron and Steel Institute.

• • •

There is a national roster of scientific and technical personnel? More than 94,000 engineers and scientists supplied professional information for the current (1954-1955) National Register of Scientific and Technical Personnel, which is sponsored jointly by the National Science Foundation and the professional scientific societies. Nearly 92 percent of those reporting were employed, 3 percent were in active military service, and the remaining 5 percent were full-time graduate students, retired, or for other reasons not employed.

• • •

Army Engineers have developed a "packaged" water treatment plant? The one-man-operated unit, which is capable of handling the emergency water requirements of 50,000 people, is the work of sanitary engineers at the Corps of Engineers' Fort Belvoir Research and Development Laboratories. Now undergoing troop tests, it is producing drinking water from the polluted Potomac. Its capacity is up to 12,000 gal per hour. The plant consists essentially of three main all-aluminum sections—an "Erdlator" (up-flow coagulation basin 14 ft in dia) and two gravity-type sand filters.

Nineteen full-scale atomic plants are being built in the United States? Total generating capacity of these plants, either planned or under construction, will be nearly 1,500,000 kw. Three of them are scheduled to start operating this year, and the rest of them by 1962. Ten of them represent joint ventures of more than sixty utility companies. Total cost of the nineteen plants is estimated at $675 million. This summary is from the Pioneer Service and Equipment Company, Chicago.

• • •

Over $5 billion went for research and development last year? The actual total, as estimated by the National Science Foundation, is $5.4 billion, or 1.5 percent of the gross national product of $363.2 billion. Government and industry together—with respective contributions of $2.8 billion and $2.4 billion—financed about 96 percent of the research. Colleges and universities furnished about 3 percent of the financing, and miscellaneous institutions the remaining 1 percent.

• • •

Turnpike travel is getting safer? In releasing comparative accident statistics for 1955 and 1956, the Pennsylvania Turnpike Commission reports that its accident rate last year was the lowest since the opening of the original turnpike in 1940. On the basis of vehicle miles traveled, the injury rate was down 10 percent in 1956; accidents involving fatalities decreased by 9.1 percent; accidents involving property damage only were down 13.9 percent; and the accident total showed a decrease of 12.8 percent. Incidentally, in the country at large, the motor vehicle death toll (at 40,000) was up 4 percent from 1955.

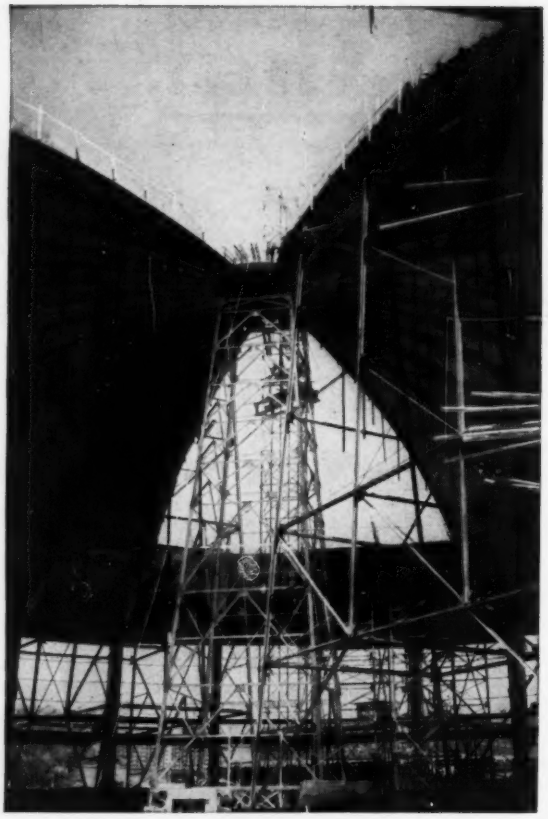
• • •

The American Institute of Architects is celebrating its centennial this year? High point of the venerable group's year-long centennial program will be a meeting scheduled for the capital city, May 13-17. The AIA has its headquarters in Washington (1735 York Avenue).

• • •

The work week of the average executive is at least 48 hours long? Executives are probably one of the groups in present-day society that are working too hard, President Mason Lockwood finds in a stimulating article, "Illusions of Leisure," scheduled for the May issue. Originally delivered at the Pittsburgh Student Chapter Conference, the article seeks solutions to many of the problems involved in leading the full professional life.

50% Form Saving



DALLAS MEMORIAL AUDITORIUM
Owner: CITY OF DALLAS
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General Contractors: R. P. FARNSWORTH & CO., INC., New Orleans
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WITH 'INCOR' IN DALLAS MEMORIAL AUDITORIUM

• Great, new Dallas Memorial Auditorium includes a 10,000-seat arena, an adjacent building with 2,000-seat auditorium and smaller meeting halls, and 100,000 sq. ft. of exhibition space under the two structures.

The main auditorium is a circular, reinforced-concrete structure, 300 ft. in diameter, with dome-shaped roof 90 ft. above 1st floor slab. Roof is carried by arch ribs, which in turn are supported by cantilever ribs extending out 45 ft. from the tops of 70-ft.-high columns.

The roof was concreted in 16 pie-shaped sections, poured in opposing pairs. These sections connect with a concrete plate, 22 ft. in diameter, at dome's top.

In cantilevers and dome, dependable 'Incor' high early strength saved 50% on forms, contributing to economies which resulted in total costs about half those estimated for alternative methods.

These economies were realized by planning with construction methods in mind . . . utilizing the principle of selective concreting—that is, using 'Incor'* 24-Hour Cement where it shows a net saving through time and form economies, elsewhere Lone Star Cement.

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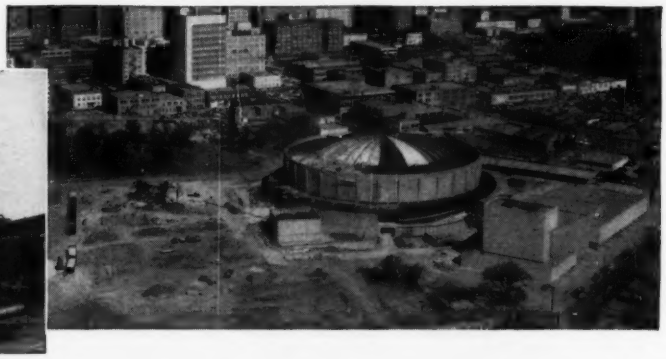

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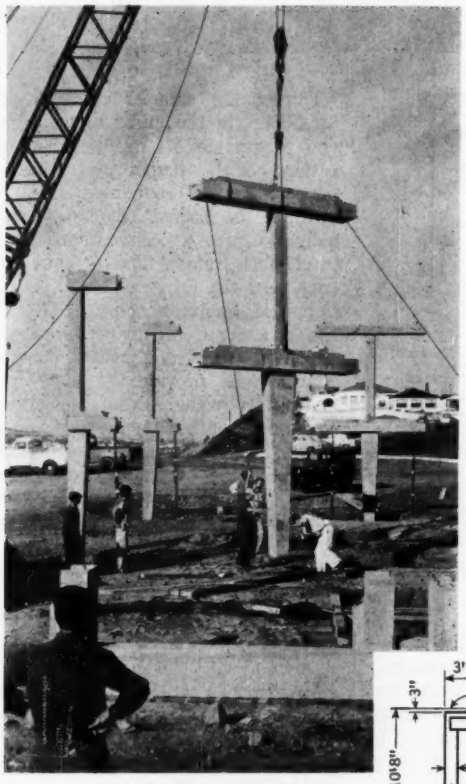
CIVIL ENGINEERING

PRECAST CONCRETE shows 21-percent saving on air-base buildings

MARVIN E. WARNER, Project Manager,
DAVID P. BILLINGTON, J.M. ASCE, Project Engineer,
Roberts and Schaefer Company, New York, N. Y.



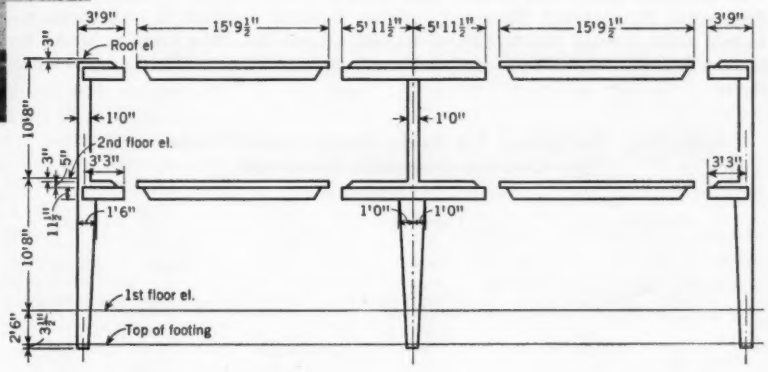
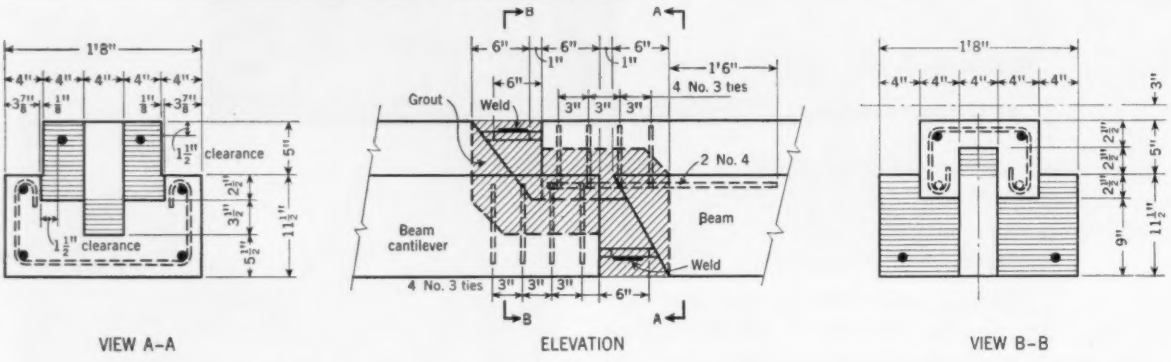


FIG. 1. Two precast elements make up frame of typical precast concrete structure for Air Force base at Lajes Field, in the Azores. Precast columns have projecting cantilevers at each story, and precast beams make connections between them. In photo, precast columns are being erected by crane.

It recently became possible to make an interesting comparison between a conventional structural steel and wood design and an alternate in precast concrete for several buildings to be erected at an Air Force base in the Azores. The resulting alternate bids showed a saving of 21 percent for the precast concrete frame design.

FIG. 2. Typical beam connection is shown for two-element precast frame. Connections between column cantilevers and beams are critical because of high earthquake and wind loads.



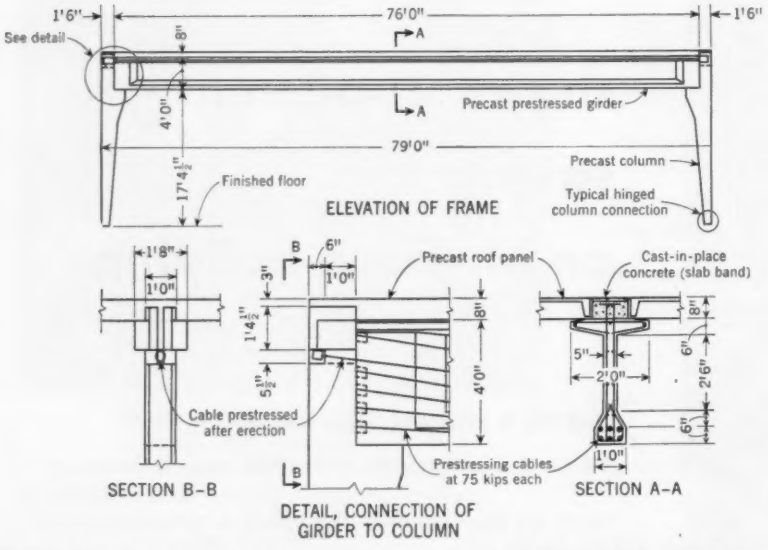


FIG. 3. Precast prestressed girders were used in two buildings at Lajes Field, the Automotive Maintenance Shop and Training Building, because of long spans required. Girders were post-tensioned against column top, thus creating frame. In Section A-A note slab "band," cast-in-place feature of all Lajes Field precast structures.

TABLE I. Bid prices for basic design (steel frame) and precast concrete alternate compared

Type of Structure	Basic Design	Floor Area, sq ft	Low Bid Price	
			Basic	Precast
Two-story Office Bldg.	Struct. steel frame with concr. slabs	26,180	$340,790	$260,498
Two-story Training Bldg.	Same	12,120	167,375	126,579
Installations Shop	Same	14,300	164,206	150,523
Installations Shop	Same	8,770	141,866	93,833
Two-story and high-bay Automotive Maint. Bldg.	Struct. steel truss with concr. deck	22,480	314,506	242,272
Dispatcher's Bldg.	Wood roof on concr. block bearing walls	2,770	39,565	42,188
Supply Shop	Same	2,720	36,181	32,250
Ordnance Shop	Struct. steel frame with concr. slab	3,230	38,806	36,813
	Totals		$1,243,295	$984,956

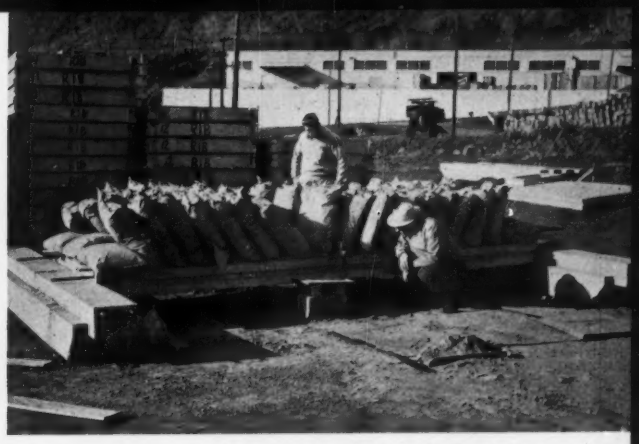
During the summer of 1953, the Air Force, in the midst of an expansion program of its overseas facilities, authorized the design and construction of several buildings at Lajes Field, in the Azores. These were originally designed as conventional structural steel frames. The Atlantic District, now the Eastern Ocean District, Corps of Engineers, engaged Roberts and Schaefer Company to prepare an alternate design in precast concrete, which would provide the same space and utility value as the basic design and would be bid on in open competition. Table I shows the type of structure according to its use, basic design material, approximate area, and actual low-bid price, for both the basic and alternate precast concrete designs.

As shown in Table I, the basic design generally utilized structural steel framing with precast concrete slabs forming the floor and roof decks. Without exception, the exterior walls were to be built of concrete blocks. All buildings were detailed using the conventional methods and materials of construction found at stateside military installations.

The prime consideration in the precast alternate design was form reuse and simple, practical details for connections. Generally speaking, two types of design were involved—precast reinforced concrete frames and precast prestressed concrete frames. In both cases floors and roofs were precast slabs and walls were solid 5-in. precast concrete slabs tilted up into place.

Precast concrete frames

For the precast design, two precast elements make up the rigid frames, as shown in Fig. 1. These are precast columns with projecting cantilevers at the floor of each story and precast beams which are connected between



Wall panels, like column bents and beams, were cast at the various building sites. At this typical casting bed and stockpiling area for precast panels (view at left), note slab being lifted by crane. In view at right, panel is being tested at load equal to 1.5 live load plus 0.5 dead load. Maximum deflection measured was 1/2 in., or 1/400th of span.

cantilevers to make the frame. These connections occur roughly at the points of inflection of the frame moments, and are secured by welding bars and casting concrete joints as shown in Fig. 2.

Lajes Field lies in the mid-Atlantic earthquake belt and here also wind forces often reach hurricane proportions. Since economical erection dictated hinged column bases, all these lateral loads had to be taken in the columns and beams of each frame. The connections between column cantilevers and beams were most critical and had to be designed carefully.

The precast roof and floor-slab panels were designed as simple beams under their own dead load and construction live loads. After erection, these panels were designed as continuous beams for roofing, topping, and live loads. Continuity was accomplished by casting a concrete "slab band" above the top of the main framing members, as shown in Section AA of Fig. 3. In this manner, the panels acted not only as continuous beams but also as part of a composite section with the frame girders

Wall panels, serving also as grade beams, were calculated to resist construction handling loads and the high lateral forces of wind and earthquake. Once in place, these panels were designed to be fully connected to the columns through keys and dowels by casting a vertical concrete joint the height of the walls, as seen in Fig. 4 The hinged detail between column and footing is indicated in Fig. 5 The foundations were designed as spread footings on undisturbed soil.

Because of these features, even though every member of these buildings is constructed separately, the final product is one fully monolithic structure designed to resist heavy and reversible loadings.

Precast prestressed concrete frames

There were two special structural conditions in this project which could not be met economically by the precast frame design. One of these was encountered in the Automotive Maintenance Shop, where a column-free working space 75 ft by 200 ft, with a 15-ft clearance, was required. For this condition, precast prestressed girders were designed as shown in Fig. 3. Again the possibility of high earthquake and wind stresses necessitated a rigid connection between precast columns and girders. To make this connection, the girders were post-tensioned against the column top (Fig. 3) thus creating a frame. Column dowels were tied into the roof "slab band" to give further strength to this knee joint.

The design of this frame provided for the following sequence of construction:

1. Girders and columns are precast on the ground. When the concrete in the girders reaches 4,000 psi, the first stage of prestressing is applied. Five of the six cables of 12 wires, each of 0.276-in. diameter, are used in this stage.

2. The columns are erected and braced; then the girders are erected and connected to the columns by prestressing Stage 2. At this point a minimum concrete strength of 4,500 psi was specified to provide for high compressive stresses in the bottom flange. It is important to recognize the advantage of this Stage 2 prestressing, where bending caused by the prestressing force not only counteracts girder bending moments but also counteracts column moments. In fact, by prestressing the system as a frame, all forces—shears as well as moments—are counteracted throughout the entire frame including girders, columns, and footings. This extra strength allows for a reduction in column and footing reinforcement.

3. Again roof panels, wall panels, and columns are all connected through dowels and keys by cast-in-place joints. Under live loads the prestressed girder acts together with the roof panels as a composite section. For this reason, full-load compressive stresses are not excessive. The full-

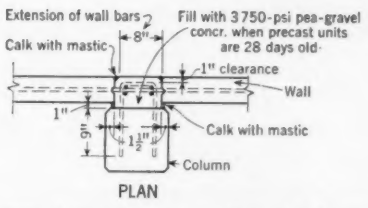


FIG. 4. Detail of connection of column to wall is seen in plan. Wall panels, serving also as grade beams, were designed to be fully connected to columns through keys and dowels, by casting vertical joint full height of wall.

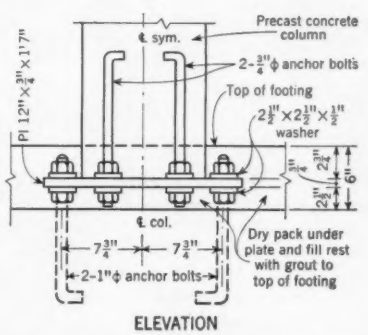
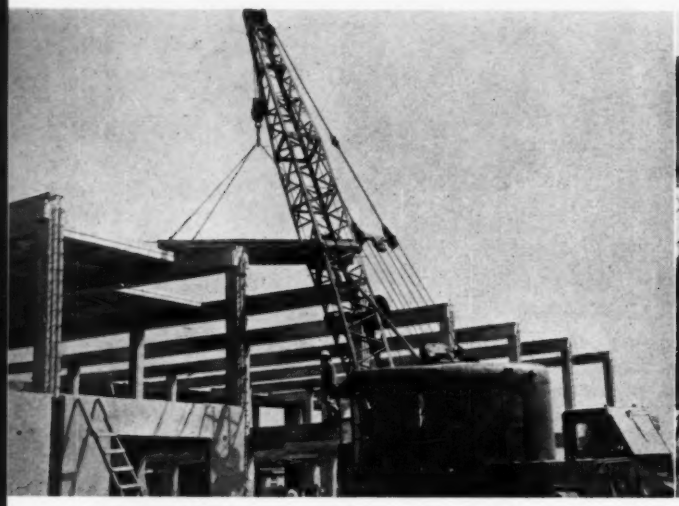
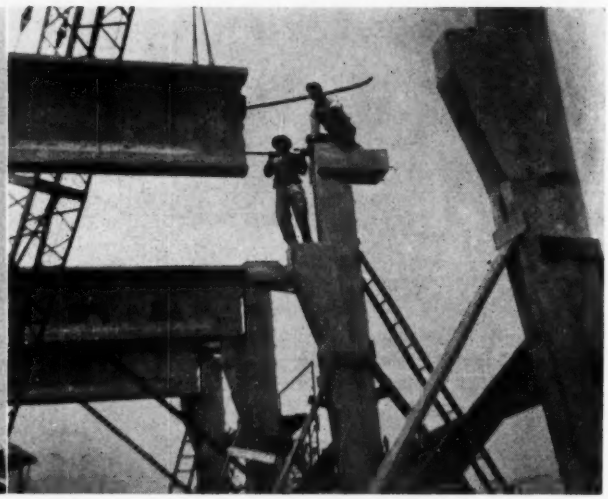


FIG. 5. Hinged detail between column and footing is feature of typical column anchorage. Foundations were designed as spread footings on undisturbed soil.





Prestressed girders, seen being erected at right, were used for two buildings where long spans were required—Automotive Maintenance Shop and Training Building. At left, precast roof panels are being erected by wheeled crane.

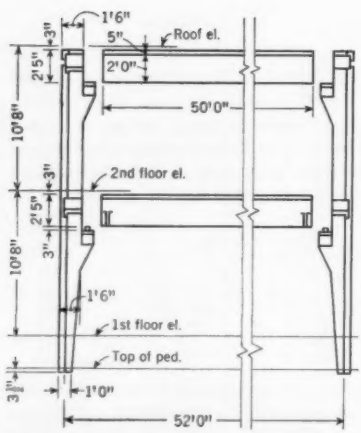


FIG. 6. Prestressed girders support second floor of Training Building. Restricted depth for floor members determined design of second-floor girder, and roof girder was made similar to permit economical reuse of forms.

load stress in the bottom flange at the center of the span is 90 psi in compression.

The other place where the simple precast concrete design could not be used economically was in the Training Building. At one end of this building it was required to provide rooms 50 by 32 ft with no interior columns—one on the first floor and one on the second floor. Because of the extremely restricted depth required for the floor members, it was decided to design a special prestressed girder to support the second floor. For economy, the same forms were used in the construction of the roof girder. An elevation of this two-story frame is shown in Fig. 6.

The girders were designed as modified hollow boxes using cardboard tubes to form the voids. Prestressing was accomplished by 6 cables of 12 wires each (of 0.276-in. diameter) in the floor girder and 5 such cables in the roof girder.

Because of the high live loads on the second floor, the prestressing force required in the floor girder would have produced excessive concrete stresses at initial application, where the only counteracting moment would have been the girder dead load. Therefore it was necessary to prestress in two stages.

The design required that only 4 cables be stressed initially. Thereafter the girder could be erected and the floor panels placed. With this additional counteracting dead load, it was possible to apply the remaining prestressing force without any overstress.

The roof girder was also stressed in two stages but only for the purpose of making a knee connection to the column. Again as in the Automotive Maintenance Shop girders, this frame prestressing introduces reversed stresses throughout the entire system, giving the structure added strength.

Fabrication of the various precast elements of the structures was accomplished in two ways. The floor and roof channel slabs were cast in a centrally located casting yard while the column bents, beams, wall panels, and prestressed girders were cast at the various building sites.

The contractor set up his central casting yard in a location easily accessible to all the widely separated building sites. In this yard, which was also established as his field office, the contractor set up his molds for the floor and roof slabs, practically all of which were of the same di-

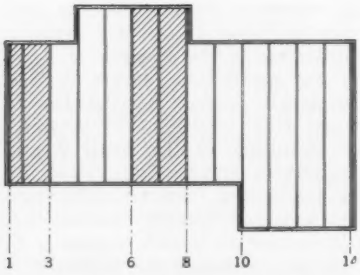


FIG. 7. Hatched area on roof plan of Maintenance Building was loaded during test program. Photo shows load, in form of gravel, being applied by wheelbarrow to depth of 8 in.

mensions, varying only in reinforcing. The casting beds were originally made up of plywood, carefully taped to give smooth surfaces without lap marks. Later, however, the forms were lined with copper sheets, which lengthened their life considerably, as well as simplifying stripping and giving more uniform and smooth finishes. Compressed-air jets were used for initial bond breaking prior to stripping.

The central yard also had facilities for steam curing the panels. After initial set of the concrete, the slabs were steam cured for a minimum of 24 hours. Stripping was effected at a cylinder strength of 2000 psi, usually after about two days, and the panels were stockpiled in the casting yard for later transfer to the building sites.

Molds for precast beam units were also set up in the central casting yard, since they were easily transportable and uniform in cross section, varying only in length and reinforcing. Thus the beams as well as the floor and roof panels could be cast, cured, and stockpiled independently of the progress of the building in which they would ultimately be used.

Column bents were cast at the site of the respective buildings. The forms were made of plywood, and in general the columns were formed and cast on their sides with the projecting cantilevers lying sideways on the ground. The forms were so positioned that the columns could be stripped and tilted up into place with a minimum amount of horizontal travel.

After the column bents were erected and braced and the precast beams placed, the ground floor slab was poured and used as a bottom form for the wall panels. Again, these panels were so positioned that, after proper curing, they could be tilted up into their ultimate location with minimum movement.

The prestressed beams were cast at the building site. In the case of the beams for the Automotive Maintenance Building, considerable difficulty was experienced in placing the concrete in the 5-in.-thick web because of crowding of the reinforcing and sheaths containing the wires. Corps of Engineers specifications prohibited the use of external vibrators, and the usual large-head vibrator would not pass through the web into the lower flange. However, by using a vibrator with a smaller head, good concrete was obtained with minimum honeycombing.

Prestressed beams for the Training Building were cast on the ground floor slab of that building, directly adjacent to their ultimate location.

Erection of the precast units was facilitated by careful planning of the erection sequence. The units were handled by cranes and erected in much the same way as conventional steel sections. Columns and bents were first placed in position and the bolted connection made at the base. After the columns were suitably braced, the beam was dropped into place, the joint reinforcing welded, and the joint concreted. Next the precast-slab panels were positioned on the beams, and the bands connecting them to the beams were concreted. The contractor then tilted the wall sections into place, concreting the joints between these panels and the columns, thus completing the shell of the building, ready for application of roofing, sash, etc.

Prestressed girders were handled in a similar fashion, except that the second-stage prestressing was effected before the roof slabs were placed. The girders received their first-stage prestressing on the ground without being moved from their casting beds. After proper curing, the girders were hoisted to their positions on the columns, and the second stage of prestressing was applied to effect continuity with the columns.

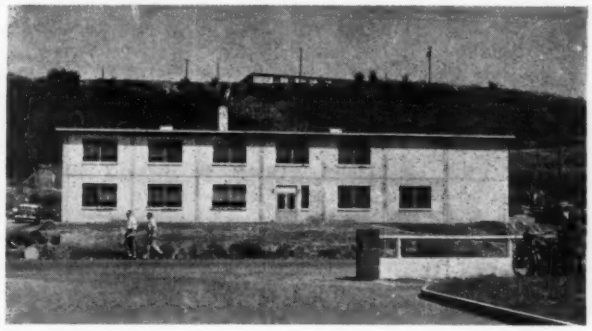
Load tests carried out

Load tests were made on some of the first slab panels to determine deflections and safety. Applied load amounted to 1.5 live load plus 0.5 dead load. The load was applied in increments, with deflections measured by an Ames dial. Under full load, which was left on for 24 hours, the maximum deflection measured was found to be about ½ in. or 1/400th of the span. Recovery was 70 percent after removal of the load. Some fine hairline tension cracks developed near midspan under full load, all of which disappeared after the load was removed.

Compressive-strength tests on the concrete used for the 75-ft prestressed girders gave erratic results. Some of the values were below the required 28-day strength of 5000 psi. For this reason, a load test was called for, and subsequently carried out. In Fig. 7, shaded areas on the roof plan of the building designate the location of the test load. Prior to testing, accurate readings were taken by instrument, on a rod which was placed in contact with the girder soffit at each support, and at the midpoint of the span. Gravel was placed on the roof to a depth of 8 in. This gave an equivalent superimposed load of 62 lb per sq ft, which amounts to 250 percent of the live load plus the total final dead load of the structure.

The load was allowed to remain in place for 24 hours, after which time elevations were again taken. Maximum deflections were 0.43 in. on the interior girder and 0.22 in. on the exterior girder. No cracks developed in any part of the test areas, and further elevation readings showed that the girder recovered completely after the test load was removed. Based on these tests, the building was accepted as structurally adequate. The project was completed early in 1955.

The complete design of the precast concrete alternate was prepared by Roberts and Schaefer Company under Robert Zaborowski, M. ASCE, Vice President. Marvin E. Warner and David P. Billington, J. M. ASCE, coauthors of this article, were respectively Project Manager and Project Engineer. Anthony F. Muscariello was Site Representative for Roberts and Schaefer Company, and took all photographs used in this article. Lt. Col. Walter P. Blum was the Area Engineer on the project, representing Col. Aldo H. Bagnulo, Eastern Ocean District Engineer, Corps of Engineers, U. S. Army. The contract was awarded to the low bidder, Macomber Construction Co. of Los Angeles, Calif., with Forrest Newburgh, Superintendent.



Typical building at Lajes Field in the Azores consists entirely of precast concrete elements—for frame, wall panels, floor and roof slabs.

WILLIAM ROY GLIDDEN, Past President, ASCE

Assistant Chief Engineer, Virginia Department of Highways, Richmond, Va.

The camel matriculates

Truly a remarkable animal is the camel. Nature has provided him with a wonderfully contrived digestive system so that he can store up a large supply of water in his stomach and fat in his hump. Thus provisioned he can spend long periods in the desert, traveling from oasis to oasis. Of all the animals who serve mankind he is the least domesticated in the sense of exhibiting traits of companionship with man. He is essentially a wild animal in spite of his centuries of servitude. He is the most stupid of all animals that man has impressed into his service. Taken from his desert habitat and allowed to shift for himself the camel soon perishes. He cannot adapt himself to new and unaccustomed surroundings or modes of living.

Many students enter college with the idea that there they will take one long drink at the fount of learning, which will suffice for a lifetime. Many wonder why the day they receive their diplomas is called Commencement Day since they feel that they have arrived at the end of the line instead of at the starting point. It is only long after, when they have been buffeted by an unsympathetic world that they realize the true significance of their undergraduate study. They discover that their fund of knowledge is not nearly so great as they had supposed, that graduation from a good engineering school does not guarantee immediate qualification for the larger responsibilities of the profession. Their ego suffers severe deflation and they fall into that slough of despond which lies across the path of all young graduate engineers.

In spite of a strong interest in engineering, and confidence in their abilities along this line, many begin to doubt the wisdom of having entered the profession. They find carpenters, bricklayers, and grading foremen receiving higher remuneration. They find non-graduate engineers with superior skills in work of a routine nature. They find in many instances that the rewards go to aggressive spirits who uncomfortably and precariously conceal their deficiencies behind a bold front. At this point many become discouraged and go into other work.

Those who survive eventually discover that they have a certain facility in solving the new problems with which they are confronted. It is then that a great light bursts upon them. Their heads had not been crammed with a lot of facts and miscellaneous knowledge. Instead they had been taught how to think. They had learned the engineering approach. These young engineers then realize that their training is not like the long drink the camel takes. Rather they have acquired the ability to find their way around, and they will not have to spend a lifetime in the desert.

Continuing study

Because the young engineer finds himself able to think through a new problem, it does not follow that he has no need of further study. Science and engineering are advancing at such a rapid pace that no one man can hope to master by experience alone all the solutions, even in a restricted field. We must know what is going on in the world around us. To determine the best solution for a given problem it may be necessary to consult engineering literature on the subject.

Sometimes a combination of two or more methods will give the most satisfactory solution, or the engineer may find it to his advantage to improvise and develop his own method. If he is a member of a technical or professional association of engineers he will then probably want to write a paper on what he has discovered for the benefit of his confreres. In order to obtain first-hand up-to-date information of this sort, it behooves every engineer to join one or several national societies in his field. By reading and making contributions to current technical literature the engineer enlarges his own knowledge and his usefulness to society, and incidentally increases his emoluments. A file of ASCE *Transactions* extending back for a number of years should be in the office of, or available to, every practicing civil engineer.

The profession advances

In the field of structural engineering alone there has been such a revolutionary advance since the turn of the century that an engineer who finished college at that time and failed to keep abreast of later advances would find himself severely handicapped in dealing with modern structural problems. Greatest progress has been in statically indeterminate structures. The old methods of analysis were so cumbersome, the theory so obscure, and the calculations so laborious, that only a select, restricted group of engineers even attempted actual design and construction of such structures.

Until recently, calculations for determining moments at centers and supports of continuous beams were avoided by the use of arbitrary moment coefficients. Some building codes and architectural specifications carry these coefficients to this very day, in spite of the fact that they can be grossly in error in many instances. An adjustment for variable moment of inertia or the effect of sidesway was not even attempted. In 1915 the slope deflection method for determining moments in continuous building frames was published. By writing equations in terms of the slopes and deflections at the various joints, the number of unknowns was reduced in many cases, and an orderly procedure could be set up and the calculations simplified. After another decade the moment distribution method was introduced. This is a method of successive converging approximations in a series of cycles, and can be carried to any desired degree of preci-

sion depending on the number of cycles. Usually three or four are sufficient.

Such terms as "conjugate beam" and "elastic weights" are to be found in the writings of the pioneers in elastic theory, but only in recent years have any of the essential principles been taught at the undergraduate level. Civil engineering literature of the past three decades probably includes more contributions on statically indeterminate structures than on all other subjects combined. Many beautiful and impressive structures of this type have now been constructed, incidentally at a considerable saving in cost.

A generation ago the science of soil mechanics was unknown; even its name had not yet been designated. While it is still far from an exact science because of the high degree of indetermination of most of the basic materials, great advances have been made and much guesswork has been eliminated in the design and construction of foundations. Many pages of current literature are devoted to soil mechanics, and every large engineering organization has its specialists to handle this phase of the work.

All these advances add up to one thing—the engineer must stay alert by continuous study. He must not close his books forever on Commencement Day.

Keep up with the profession

During the first few years following graduation, while the engineer is finding himself before settling down to a well defined career, he has an excellent opportunity to review his college work. He should purchase books and compare them with the texts he used in the classroom. He will be surprised and enlightened by a different viewpoint, will develop a critical attitude and broaden his outlook. Yet he must not accept blindly the authority of the printed page. All steps leading to the development of a new theory should be reviewed and conclusions tested by the results of his own observation. Printed material is not sacrosanct; it may be fallible. When you have acquired the ability to think for yourself, and can successfully defend your own conclusions, you are truly educated. You have become imbued with the scientific spirit and have found the engineering approach to the solution of your problems—even those of life itself.

Fortunate indeed is the young engineer who is in or near a center of population where there are well developed educational facilities. Many of our leading universities offer night courses among which he may find instruction suitable for his particular needs as they become evident. Then of course there are correspondence schools and the extension divisions of state universities. However, the young engineer should develop the habit of self-reliance early in his professional life. Sooner or later he will encounter problems for which there is no precedent and he will be entirely on his own. Ability to meet such challenges is a measure of progress, and success in his career will be in proportion to this ability.

As the engineer rises toward the top executive positions, he will feel the need for a broadened outlook. Some of our leading engineering schools require in their regular curricula a study of such subjects as economics, business law, and control of personnel. In our highly complex society these subjects are becoming increasingly important, and the successful man, whether an engineer or a leader in some other field, must be informed about them, which means that study must be resumed as the need arises.

In the pursuit of success the factor of opportunity may often be important. When opportunity does come, we must be prepared, otherwise it may pass us by. Some adventurous spirits make their own opportunities.

Keep your eyes open

Education is by no means confined to the lecture hall and the printed page. Much can and should be learned by observation. Never pass up an opportunity to see work under construction. It is important to know how the various materials of construction are produced, processed, and assembled in final position.

When traveling, study the many types of construction used for bridges, viaducts, elevators, tanks, electrical catenary systems and other structures that pass before your gaze. You will be surprised at the many evidences of poor engineering, careless workmanship, and the prevalence of rusty metal and deteriorated concrete.

Be outgoing

Do not overlook the human side of your education. Be an extrovert and meet with others having the same or similar interests. Confining yourself to books will make you an introvert and cause you to lose valauble professional and social contacts. Join a technical society as soon as you can. You will find the communion of interests and exchange of ideas of immense value as well as the good fellowship. Cultivate the friendship of the older men in the profession; they will help you over some of the pitfalls that lie ahead. Do not be deceived by the outward austerity that often cloaks a warm heart. The only people to avoid are those arrogant fellows who think they know practically everything.

As an escape from worldly cares, there is nothing better than a hobby that is entirely unrelated to your work. A great deal could be said about this subject of hobbies. Those who appreciate an evening of fine music can find it intoxicating—and there is no morning-after hangover.

As the older engineers pass from the scene, their places will be taken by those who are now students or recent graduates. Many of these will some day become executives and leaders in the profession.

In the main, there are two kinds of executives—those who drive and those who lead. Frequently the driver is one who relies on the authority of his position rather than on his personal ability and participation in professional progress. His employees have no spirit, no pride in their work, little incentive to increase their efficiency, and they depend on collective action when possible for advancement. As a final resort, they quit.

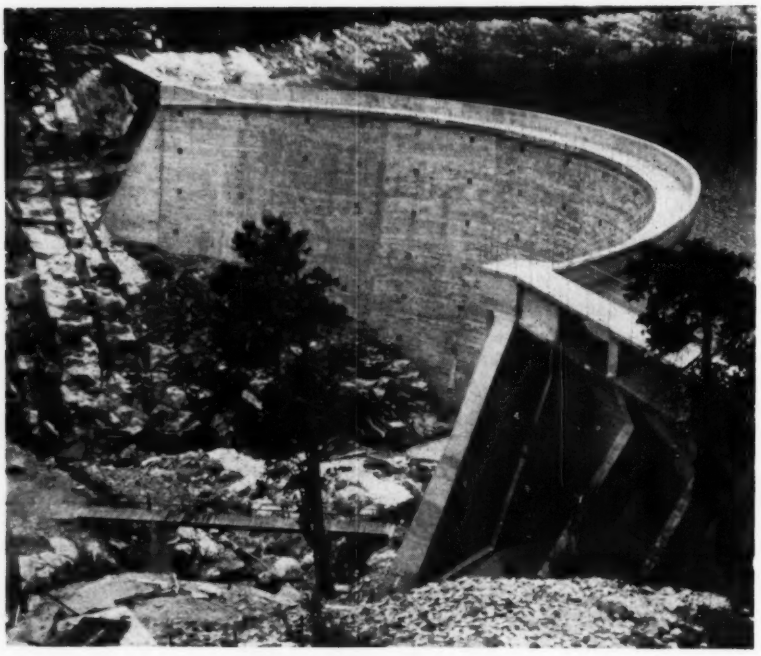
The leader is one who maintains a strong and active interest in the profession by keeping up with and testing new developments. He is himself an originator and exchanges ideas and experience with other leaders. He enjoys the respect of his co-workers. He breathes enthusiasm and inspires all who work with him by his own example. He encourages his subordinates by trying out their ideas and assists them by recommending courses of study that will augment their usefulness and lead to their advancement. His employees are reluctant to seek greener fields, frequently remaining at their posts even when it involves financial sacrifice.

The business of life may be an onerous task or it may be an exciting adventure. It all depends on your attitude. There is no greater joy in human experience than the accomplishments of the intellect—all others are transitory. Emerson once said that the greatest reward for a job well done was having done it.

It should be evident that one long drink at the fount of learning will not suffice for life's journey. The camel is a beast of burden because he has deficient brain power. A brain not used is little better than no brain at all. Why be a camel?

C. F. GRONER

Consulting Hydroelectric Power Plant Engineer, Oslo, Norway



THIN ARCH DAMS favored

In Norway for the past fifty years the development of hydroelectric power has been a vital factor in the economy of the country. Dam construction, for special reasons, has followed a different path from that in most other countries. Norwegian dam sites are located in varying climates and at different elevations ranging from sea level up to 4,000 ft (1,200 m). Most dams are slender reinforced concrete structures for the following reasons:

1. As the transportation of building materials in the mountains is expensive, and the yearly construction season at high altitudes is only five to seven months, the total amount of material that has to be transported for a dam must be reduced as much as possible.

2. The water in our lakes and rivers is acid (pH from 5.6 to 6.7) and exceptionally clean. Therefore the water seeping through joints and cracks has no sealing effect.

3. In a thin dam it is easy to locate any subsequent leakage and to trace it to its source. This is considerably more difficult in heavy construction where the water may take an untraceable course through the dam.

Thanks to narrow valleys and good rock for foundations, there are a number of excellent arch-dam sites in Norway. Our first reinforced concrete arch dams were built about 1930. Since that time many such dams have been constructed (Fig. 1), up to a height of 164 ft (50 m). At present, one 230 ft (70 m) high is under construction.

Shape of dam sites

Arch dams are used at sites where the length-to-height ratio of the dam is as much as 7:1. The usual ratio is 3:1 or 4:1. The sites fall naturally into five categories:

1. U-shaped dam sites where the sides of the valley serve as abutments for the arch for the whole height of the dam.

2. U-shaped dam sites where the river has eroded weak material out of the river bottom. Normally this part has to be concreted first to form the foundation for the arch. See Fig. 2. In cases where there is a fault in the middle of the site, sheetpiling may be used to tighten it in special cases.

3. U-shaped valleys which broaden out considerably at the top. When an arch dam is selected for this type of site, the usual procedure is to construct the arch in the center of the profile and to place, at one or both ends, artificial abutments connected to flat-slab buttress dams or earth-fill dams. These combination dams complicate construction somewhat but have proved satisfactory. By avoiding the long, relatively flat arch dam, a considerably shorter radius is required, which in turn permits a less heavy dam section. This represents the most common type of arch dam in Norway. The Vatnedal Dam, Fig. 1, is an example.

4. The long, relatively low sites where multiple arch dams are employed. Only three such dams have so far been constructed in Norway and this type is not considered in this article.

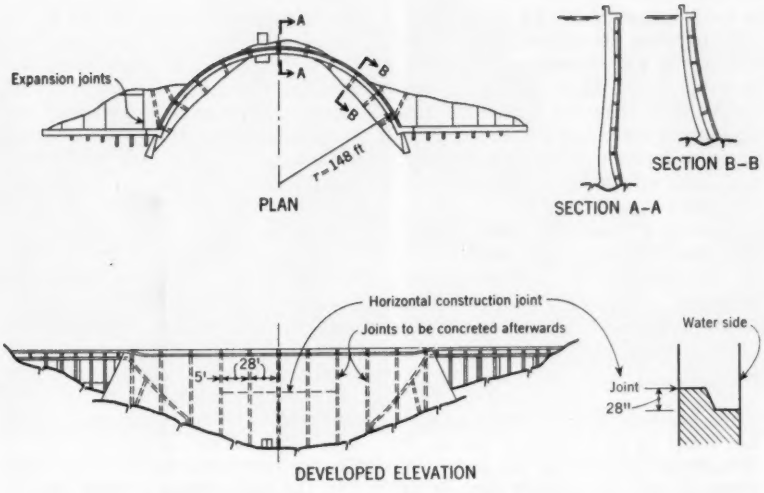


FIG. 1. Typical Norwegian concrete arch dam for U-shaped valley is Vatnedal, 98 ft (30 m) high. Note central arch with short constant-angle radius and side sections of flat-slab and buttress construction. In photo, note windowed insulating wall on downstream face, also buttress supports for side section in foreground.

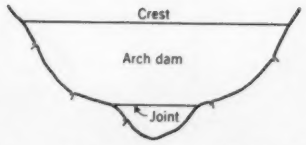


FIG. 2. At sites where bottom of U-shaped valley has been eroded, section of dam to fill this area is poured first.

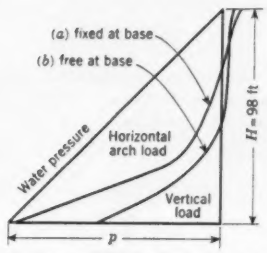


FIG. 3. Loads carried by arch and cantilever action in Vatnedal Dam are shown for two conditions: (a), when vertical section is assumed fixed at base, and (b), when vertical section is assumed hinged at base.

in Norway

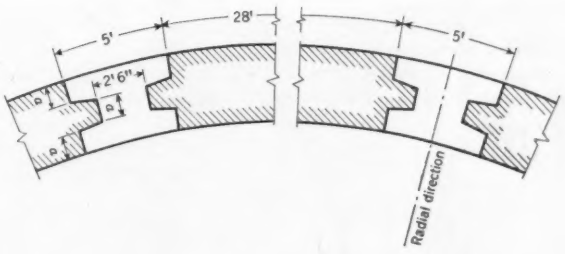


FIG. 4. Dentated contraction joints, without water stop, are poured in cold weather after alternate 28-ft (8.5 m) sections have reached full height and have attained nearly freezing temperature.

5. Canyon dam sites, which are not common in Norway.

Principles of construction

Smaller arch dams are designed mainly on the principle of constant radius, but large dams are designed often with a constant angle and variable radius (Fig. 1). The cylinder formula is used for the design of the smaller dams.

For larger dams, the trial-load method usually is employed using a series of horizontal arch sections and only one vertical cantilever section. In special cases, three vertical sections are calculated. Usually the vertical section is not considered fixed at the base. Fixity at the base means that a disproportionately large part of the water load is assumed to be taken by the vertical section. In an arch dam most of the load ought to be taken by the arch, that is, the arch should be the primary bearer. For the Vatnedal Dam, Fig. 3 shows the load carried in the horizontal and vertical direction, when (*a*), the vertical section is assumed to be fixed at the base, and (*b*), when this section is assumed hinged at the base. In certain cases a construction joint is formed at the base but normally the arch sections are concreted directly against the rock. Harmful cracks do not occur on the upstream face.

The Norwegian Water Course and Electricity Board has determined that the allowable concrete stresses should not exceed about 710 psi (50 kg per cm^2), and the buckling safety factor should be about 8. The dam is designed for a temperature rise and fall, when empty, of about 36 deg F (20 deg C) at the crest and 18 deg F (10 deg C), at the base; and when full, for a variation of 18 deg (10 deg C) at the crest and 9 deg F (5 deg C) at the base.

As a rule, the quality of the abutment rock is good except for the center part which comprises the actual river bed, where the rock may often be of rather poor quality. Rock conditions have required occasional grouting but the base usually is grouted after the dam is completed and while the reservoir is being filled. Any leakage in the rock can then be located, and grouting can be applied to stop it.

The dams are cast in vertical sections having a width of about 28 ft (8.5 m). Between sections there is a 5-ft (1.5-m) dentated contraction joint which remains open until the completion of the construction period (Fig. 4). Each section is calculated to resist maximum wind pressure. In the case of arches of constant angle, there is a considerable

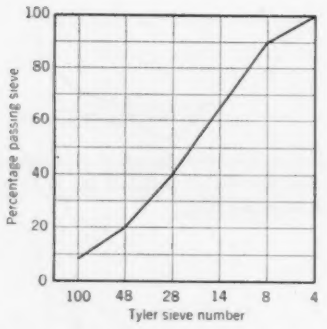


FIG. 5. This grading curve for sand is followed as closely as possible. Natural sand and gravel are used when available.

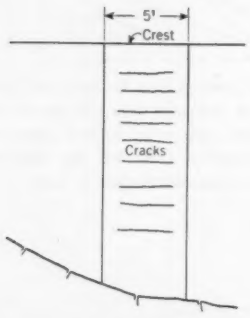


FIG. 6. Horizontal cracks may be caused by heat of setting when contraction joints are poured too rapidly or at too high an air temperature.

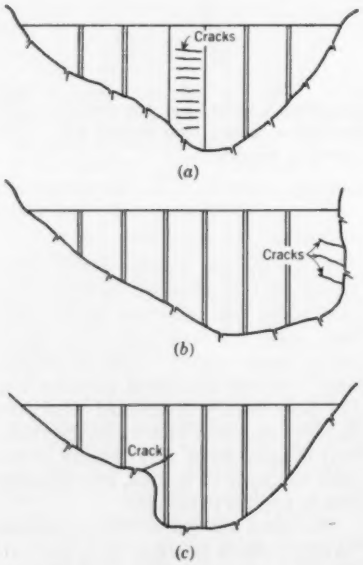


FIG. 7. Norwegian experience with arch dams in U-shaped valleys shows three construction procedures to be avoided: (a) pouring a section without contraction joints, (b) pouring a section against vertical rock face, and (c) allowing foundation rock to project into dam.

overhang at the quarter points, and reinforced concrete columns are used as temporary supports for the section.

By reducing the number of joints in a dam, the risk of seepage is reduced to a minimum. Each section is cast continuously from the bottom to the top, except where a section has a greater height than about 75 ft, when the pour is divided with a horizontal construction joint like that shown in Fig. 1. No sealing strips are used for any of these contraction or construction joints. All cast surfaces are very thoroughly roughened and washed before pouring is continued. Great care is taken to prevent seepage.

Placing concrete

The concrete mix normally employed has about 25 lb of cement per cu ft of concrete (350-400 kg per cu m). A minimum concrete cylinder strength of 3,300 psi (232 kg per cm^2) after 28 days is required. Great importance is attached to the correct grading of sand. To the extent possible, the sand curve shown in Fig. 5 is followed.

Natural sand and gravel are employed when available, but often crushed sand and stone must be used. Air entraining agent is added to the concrete to provide a maximum air volume of 3 to 4 percent. Internal vibrators are used during casting. The sections are poured at a rate of a 12-in. to 20-in. (30- to 50-cm) rise per hour, this slow rate being necessary to avoid a large temperature rise during construction.

Contraction joints are concreted at the rate of about 12 in. per hour. It is extremely important that this rate be not exceeded in order to avoid cracking due to the chemical heat developed by the setting of the concrete. Contraction joints are concreted when the air temperature is about 32 deg F and after the adjoining sections have been cast at least three or four months. By this time the completed concrete has contracted as a result of shrinkage and temperature drop. If contraction joints are concreted at too high an air temperature, or if the pouring is done too rapidly, enough heat develops to cause horizontal cracks, as shown in Fig. 6.

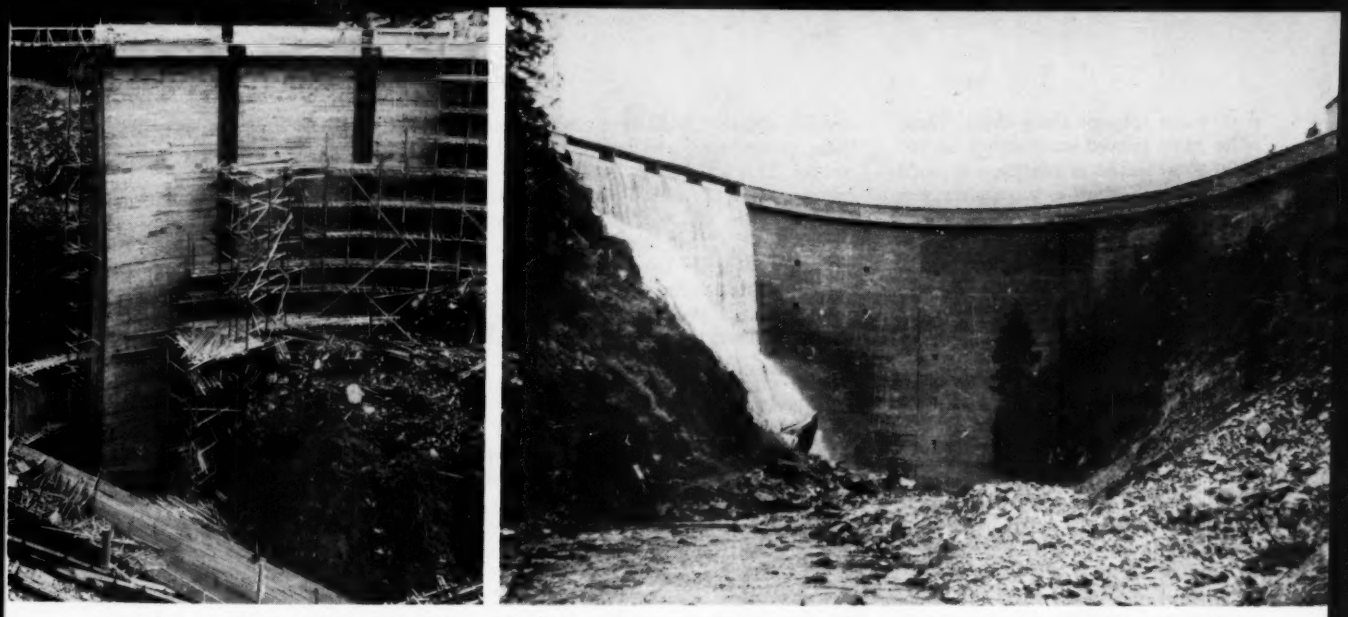
The side sections usually are cold enough for pouring of the contraction joints between them when the air temperature has dropped to 32 deg F (0 deg C). It is important that the formwork be tight to prevent the concrete surfaces from cooling below the freezing point. Artificial heating is often necessary before concreting begins. Electricity is preferred for this heating.

If the temperature is below freezing for a long time, the formwork must be insulated. A movable enclosure ought to be erected 12 to 15 ft (4 to 5 m) above the rock surface in the contraction joint in order to heat the lowest part of the joint. When concreting has begun, the setting temperature will normally maintain the air and side surface of the sections above the freezing point. As concreting proceeds the roof is gradually moved upwards.

To avoid involuntary joints, concrete must be poured in the form at least three times per hour. Under these circumstances a concrete mixer would not be fully employed, and consequently several joints are usually concreted at the same time. During concreting of the contraction joints, vibrators are used to work the concrete into corners and against the side sections.

Temperature inside the concrete of

Juvann Dam, constant-angle arch 160 ft high, overhangs at quarter points enough to require temporary support during construction by reinforced concrete columns at left. Note dentated edge in foreground, provided for contraction joint. A horizontal construction joint also was required. Neither water stops nor sealing strips are used.



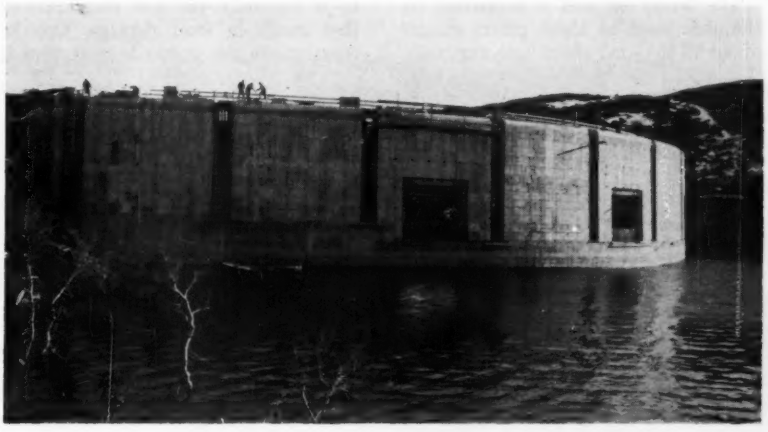
Langli Dam, 155 ft (47 m) high, is seen (above, left) during pouring of main sections of arch, and (at right) completed, with water flowing over spillway. In view at left note gaps for contraction joints, to be poured later, and above, note windows in insulating wall.

the contraction joints varies greatly. In the middle of the joint the temperature will be considerably higher than at the edges adjoining the cold sections. I have taken temperature readings in the concrete of a contraction joint of an arch dam 98 ft (30 m) high, poured while the air temperature remained below freezing by as much as 10 deg F (−12 deg C) (in November and December), and found the temperature in the joint to be above freezing.

In certain cases the center section of a dam has been concreted without contraction joints but as a rule this has resulted in a certain amount of small horizontal cracking due to the large difference in temperature between the middle and the sides of the section. The same conditions prevail when concreting against a vertical rock face. Slightly diagonal cracks will develop against the rock face on account of the temperature difference. Sharp changes in height are carefully avoided at the base of the dam. It is necessary to level out the base; otherwise experience has shown that diagonal cracks will develop as shown in Fig. 7.

Formwork must not be removed before the temperature in the concrete has fallen approximately to air temperature. This procedure will avoid temperature cracks caused when the warm surface of the concrete comes in contact with the colder air. Water curing is required for at least three weeks after concreting.

Formwork is attached by means of bolts which at the upstream face are fitted with welded steel collars to re-



Constructed in flat valley, Skjerkavann Dam has ratio of length to height of 7:1. In upstream view contraction joints are being poured. Note two temporary openings for river flow. Completed dam is seen below.

duce water seepage along them. These bolts have proved satisfactory in the main sections but in contraction joints no bolts are permitted to pass through the concrete. The outer parts of the bolts are unscrewed when the formwork is removed. The holes in the concrete surface, about 2 in. deep, are then cleaned and filled with mortar.

Permanent insulating wall

Because of the slenderness of these dams, a certain amount of dampness will remain in the concrete as free water even close to the downstream face, no matter how compact or well proportioned the concrete may be. In the winter, with low and varying temperatures, frost damage will occur in the course of time. To avoid this, a permanent insulating wall is built to protect and insulate the downstream face against frost damage. This wall is normally of reinforced concrete 4 to 6 in. (10 to 15 cm) thick, placed at least 31 in. (80 cm) from the downstream face of the arch, as shown in the cross sections A-A and B-B of Fig. 1.

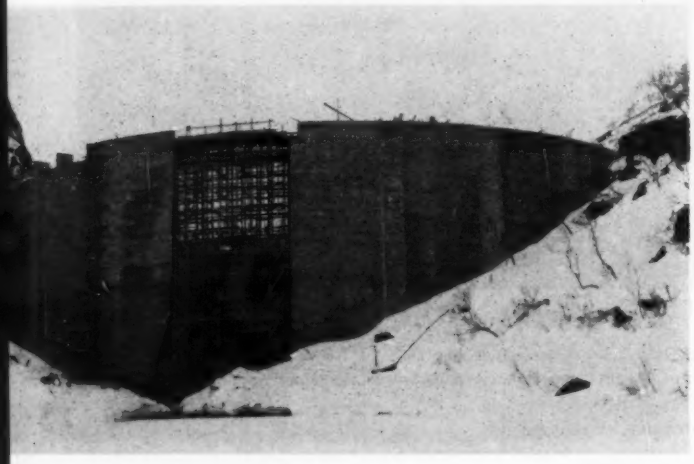
The insulating wall is supported on the arch itself by short pillars spaced about 13 ft (4 m) apart both vertically and horizontally. Walkways erected on these pillars facilitate inspection and control. This wall has no great insulating properties of itself; its main object is to provide still air on the downstream side of the dam. As a result, the temperature of the dam itself during the winter normally will be above freezing. The lowest temperature observed behind these insulating walls is about 19 deg F above zero (−7 deg C) even when the air temperature outside was as low as 20 deg F below zero (−30 deg C). The insulating wall is sometimes constructed of impregnated woodwork. It is fitted with windows, and in some cases facilities are provided for heating the air between the arch and the insulating wall.

The oldest arch dams in Norway are now more than 25 years old, and no damage of consequence has been observed on them. However, without an insulating wall there is no doubt that frost damage would occur. This has been clearly shown in a number of small intakes where an insulating wall has not been considered worthwhile. It is not only the low temperatures that result in frost damage. On the coast where the winter temperature is relatively higher, frost damage occurs because of repeated freezing and thawing during this season.

Cement plaster is applied only to the crest of the spillways as experience has shown that plaster elsewhere on the dam is unsatisfactory in a cold climate. Our experience with other types of waterpower construction shows that concrete with cement-plaster rarely is satisfactory.

For the larger dams the average construction cost ranges from $45 to $55 (U. S.) per cu yd of concrete; for the smaller dams, this cost may be $55 to $75 (U. S.) per cu yd, depending on the location of the site.

To sum up, Norwegian arch dams are constructed as slender reinforced concrete dams. They are built with comparatively few construction joints, and such joints are dentated to stop seepage. The downstream face is protected with insulating walls to avoid frost damage. Our experience with reinforced concrete arch dams has been excellent, and we consider these dams, when the site is suitable, to be superior to all other types both because of their safety factor and because of their statically correct force distribution.



Bergdal Dam is seen during pouring of last section (at left) and after completion (below). In view at left note contraction joint pours, and in lower view, overflow sections.

HIGHWAY SIGNS for the Interstate System

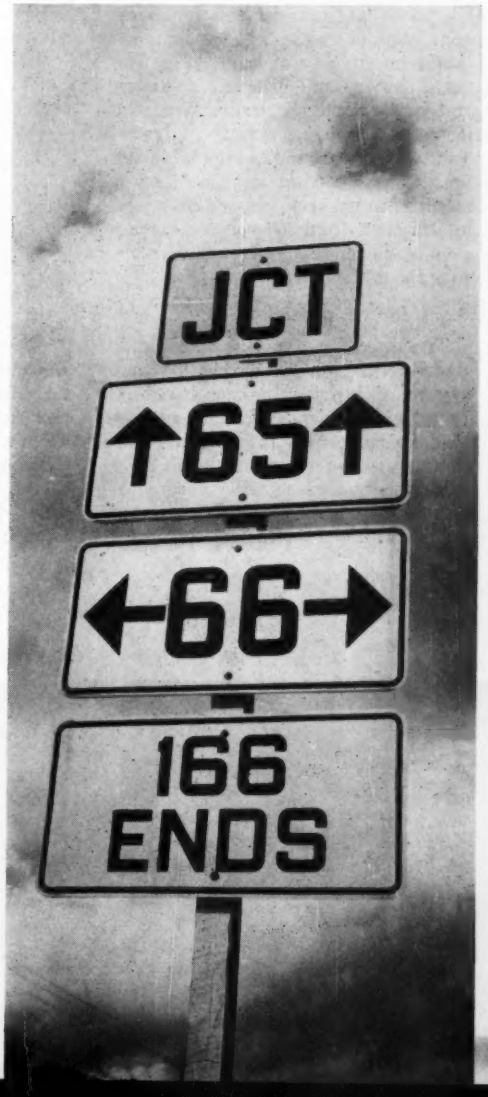
A. E. JOHNSON, M. ASCE

Executive Secretary, American Association of State Highway Officials, Washington, D. C.

Highway marking with directional signs is an art that has grown with the evolution of automotive travel. The concept of a large volume of traffic moving rapidly over great distances on broad, limited-access highways introduces new problems in the adequate marking of highways. A motorist cannot read small signs at high speeds. He must be warned well in advance of turns and intersections or dangerous congestion will occur. Since the new Interstate System is intended to carry traffic for long distances, uniformity throughout the country is highly desirable. Under the impetus of the National Road Program, road building will be vastly accelerated. Now is the time to establish a workable signing system.

The first road markings and maps in this country were crude but relatively effective. Those first crude efforts helped the pioneers scatter to the four corners of the country and create our great nation. From that time on, the economy and the living standards in the United States have been closely geared to transportation. The highway industry now contributes one-seventh of the gross national product, and the very pattern of living in America is based on the convenience and widespread use of the automobile.

The first highway signs were such things as blazed trees, piles of stones, and improvised markers indicating the best places to ford streams. The first road maps were crude drawings showing the location of a trail with relation to mountain passes, unusual trees, stream forks, large or unusual boulders, prominent mountain peaks, and the like. Road information was obtained by word of mouth from the occupant of a nearby pioneer cabin, who would advise as to which fork of the road to take for a certain destination.



Good highway signs should be easily read without delay. This one is on a Missouri State Highway.

The introduction of the motor vehicle in 1893 brought about a radical change in our travel habits and had an unprecedented effect on the American economy and way of life. The phenomenal increase in the number of motor vehicles and in their use has been responsible for our great road building programs and, in turn, for the development of highway signing as it is today. Proper signing is essential to make a highway functional.

Originally a trail or road bore the name of a destination, a prominent local family, an outstanding national hero or statesman, or perhaps that of some stream or mountain pass. Later and up until the World War I period, much of the marking of routes in the United States was done by trail associations. The routes sponsored by individual associations varied from short stretches of road to transcontinental routes. One of the best known examples of this type of highway is the Lincoln Highway extending from coast to coast.

Later, as traveling increased, the multiple signpost type of installation developed. Such an installation would be placed at intersections, junctions, and forks of roads, and would contain a multiplicity of signs, indicating the directions and distances to towns and cities along the route. With the increased speed and density of traffic, this type of direction became obsolete, for it was obviously impossible for a motorist to read and digest the needed information from a vehicle moving even at moderate speeds without stopping the traffic flow.

Signs for high-speed traffic

The necessity for directing traffic traveling at high speeds has led to a system of highway signing based on route numbering, directional arrows, and the name of a major or destination city along the route. Such signs are used by the motorist in conjunction with a modern road map produced at the cost of a few cents each and furnished free of cost to the motorist mainly by the state highway departments and major oil companies.

The most efficient highway marking in the United States is generally on the 700,000 miles of routes under the jurisdiction of the state highway departments, and the best signing on state highways is usually on the rural sections. Probably the greatest variation in highway signing practice is in the directional arrow and in the letter size used on informational signs. Many states are lax in the adequate use of cardinal direction signs and of confirmation route markers to reassure the driver that he has taken the right road after he has passed through an intersection or left an urban area.

It is mostly in urban areas, where highway traffic is directed over conventional surface street systems, and where many turns and indirection are involved, that current signing leaves much to be desired. Signs must be large enough to be legible, located where they will not be obstructed by parked vehicles, frequent enough to give assurance to a stranger, and placed far enough in advance to prepare the driver to turn at the proper location.

Highway signing as we know it today in the United States has evolved over a forty-year period. Personal ideas, individual preferences, local experience, and the general application of some limited scientific data have all had their part in the final product. Shapes and colors that are in general use have been developed over the span of two-score years.

The first transcontinental automobile trip in 1903, and the first transcontinental motor-truck trip in 1911, focused attention on the need for a simplified and efficient method of marking routes. Immediately after World War I, this country experienced an unprecedented road development program. It was during this period that the first comprehensive federal-aid highway program started. New methods, new equipment, and new materials were being developed for road building. It became apparent that a simplified route marking system was an absolute necessity for an extensive highway network such as was then being created.

Advance notice of intersections is important in avoiding congestion. Shape of sign (note standard U. S. shield) is helpful to driver in quickly determining route.

On modern high-speed highways, not all signs can be placed at the side of the road. Some must be on over-

Route number method developed

In 1918, Wisconsin first developed the distinctive route marker and number method of designating highways and directing travel over them. In 1922, the Mississippi Valley Association of State Highway Officials recognized the need for uniform signing and took the first steps toward establishing distinctive signs by adopting the round sign for rail crossings, the octagonal for stop, the diamond sign for caution, and the rectangular for informational. It recommended that all signs be 2 ft across, since the then current manufacturing processes limited products to that maximum dimension. The adoption of the round sign however had some precedent, as it had previously been used by several states to mark rail-highway crossings.

In 1924, the American Association of State Highway Officials recommended uniform sign practice based to a large extent on the action at the Mississippi Valley Conference but added distinguishing colors for luminous signs, such as yellow for caution, red for stop, and green for safety. It was some years before the reflectorized sign came into extensive use, awaiting the development of economical and efficient reflector buttons and reflective sheeting.

Non-luminous sign colors, as recommended in 1924, were confined to yellow, black, and white. All this information was contained in the report of the AASHO Committee on Traffic Control and Safety Devices. The report also indicated the need for marking the best and most direct major arterial routes connecting population centers and extending through two or more states, in the direction of the major travel desire, with a distinctive route marker and a single route number for each continuous route for the convenience of the motoring public.

In 1925, as a result of the action of AASHO in 1924, a committee was appointed to work on the problem of selecting and marking such routes. This committee was made up of 21 members from the state highway departments and 3 from the Bureau of Public Roads. The committee reported in October 1926, and in November 1926 the AASHO took steps to establish the U. S. numbered system, indicated by its distinguishing shield, now so familiar to all. The system at the time of its creation consisted of 96,626 miles.

This system now comprises 160,000 of the some 235,000 miles of the Federal Aid Primary Highway System in the several states. The U. S. numbered system is administered by the Executive Committee of AASHO following recommendations by its Route Numbering Subcommittee. The several states abide by the decisions of the Executive Committee in establishing routes, assigning numbers, and altering routings solely on the basis of agreement between their highway departments and the committee.

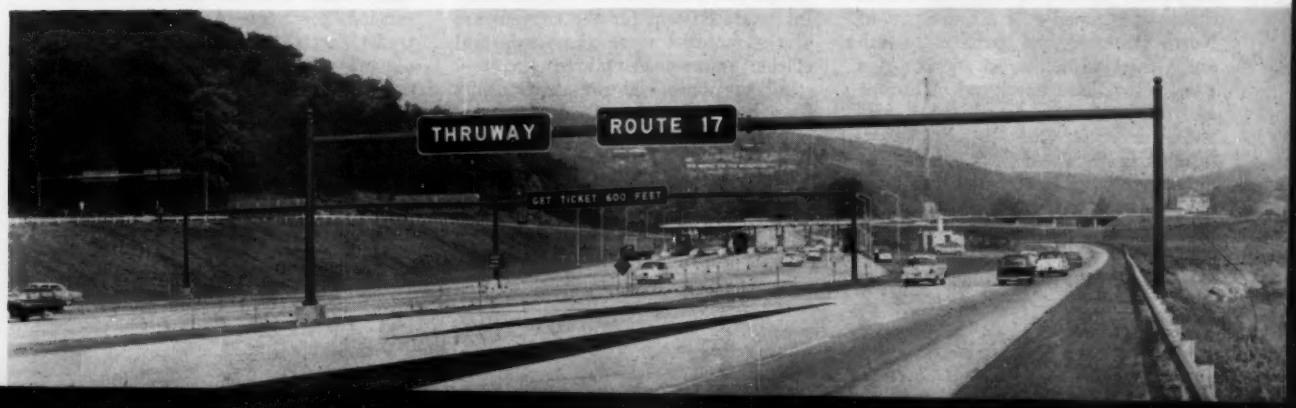
Manual for uniform signs

In 1927, the first Uniform Manual for highway signs was developed by the AASHO, and this forms the general basis for the recommended signing practice in this country. Soon after, the National Conference on Street and Highway Safety also published a recommended procedure. Since obviously there could not be two standard practices for highway signing, a Joint Committee of the two authorities was established in 1931. In 1942, when this Joint Committee was expanded into its present form, another interested and expert group was included, the Institute of Traffic Engineers. The Joint Committee, consisting of 7 members from each of the three organizations, with a Bureau of Public Roads employee as its secretary, is responsible for developing the Manual of Uniform Traffic Control Devices for Streets and Highways and referring it to the three organizations for approval. The Manual is then published by the Bureau of Public Roads, Department of Commerce.

The first printing of the Manual was in 1935, and subsequent editions appeared in 1937, 1939, and 1942—the war emergency edition. The current edition was issued in August 1948 and

Secondary roads should be clearly indicated as is this farm road in Texas.

head structures. All must be easy to read at a distance and illuminated for equal visibility at night.



the supplement in 1954. This Manual covers uniform definitions, signs, sizes, shapes, colors, and installation of highway signs, as well as recommended practice for other traffic control devices and highway striping.

In 1944, action was taken at the federal level to encourage nationwide uniformity in highway signing. The Federal Aid Act of 1944 recognized the need for uniform practice and authorized the Bureau of Public Roads to require uniform signs and traffic control devices on federal-aid projects to comply with the Manual. At present there is substantial compliance with the recommendations of the Manual in the several states, but in some areas considerable more personal and local preferences are followed than can be justified.

Although much remains to be done in obtaining the desired degree of uniformity, foreign visitors have little difficulty in taking a road map in hand, getting behind the wheel of an automobile, and driving from coast to coast. There cannot be too much wrong with the efficiency or utility of current signing practice.

All the states have developed a distinctive marker to indicate their state highway routes, and the familiar shield is used to mark the U. S. routes, which are state highways. Complete uniformity is not even found in the size and shape of the U. S. Route shield used by the several states. Practice, however, has been generally uniform for the basic signs. A round sign with a yellow background is recognized as the mark of a rail-highway crossing; a diamond-shaped sign with a yellow background is indicative of warning or caution; a small rectanguar sign with a yellow background is recognized as indicating the advised safe speed on a curve. A white rectangular or square sign is recognized as informational or guide, and the last distinguishing shape to be added is the equilateral triangle with the point down and a yellow background, indicating that right-of-way should be given to traffic on a preference route. The public has learned to associate the outline of a road sign with its function.

Just as a distinctive sign practice has been developed in the United States and spread over a great part of North America and parts of South and Central America, so another sign practice has been developed in Europe and much of the colonial world, providing a substantial degree of uniformity in those areas. The two systems have little in common, but since few motorists travel between these two geographical areas the need for a uniform sign practice is not critical at this time.

The American system depends largely on route numbers and short word messages, and is based on the original actions of the AASHO in 1922 and 1924. The European system is better suited to a polyglot world, and utilizes universal sign-language symbols. Routes are indicated by designation instead of by number. In sign shape and color, there is also little agreement between the two systems.

Need for uniformity emphasized

The establishment and construction of the 41,000-mile Interstate System of nationwide superhighways emphasizes the need for uniformity in sign practice to an extent never before called for. These routes, joining practically all the cities of over 50,000 population, and all the main international routes in North America, are currently carrying some 16 percent of the nation's motor traffic. With the design standards proposed for this system, an average full day's drive will amount to some 600 miles and take the motorist through two or more states. Long-distance motor trips will increase. At present many hesitate to take a long motor trip because of traffic congestion, the risk of accidents, and the large mileage of obsolete main highways where driving is a strain. With the building of the Interstate network to the proposed design standards, new traffic will be generated and current traffic attracted from less desirable routes with the result that this network, comprising 1¼ percent of the nation's 3.4 million miles of public roads and streets, will carry from 20 to 25 percent of all its motor travel.

Present engineering studies indicate that, in order to accommodate the necessary geometrics and acquire the necessary rights-of-way at a reasonable price, 75 percent of the 41,000 miles will be on new location. This would mean that 25 percent of the system would be over routes currently marked by the U. S. Route shield. Thus 75 percent will have new route marker signs. It is the opinion of the Executive Committee of AASHO that a new and distinctive marker should be developed to designate the Interstate System for the convenience of the motorist using these safe and efficient transcontinental routes.

All the state highway departments have been asked to submit suggested marker designs for the Interstate System, and it is expected that the Route Numbering Subcommittee will make a selection by midsummer. Suggested designs are already being submitted, the most prominent being a broad stemmed "I" with a route number in the center, an outline of the United States carrying a route number, and a shield of some sort carrying a route number. Several designs have been submitted in three colors—red, white, and blue. Some of the suggestions would mark the Interstate routes by number, some by letters of the alphabet, and some by a combination of the two.

The present Manual contains those signs that are needed for marking conventional city streets, rural primary, and rural secondary highways. The 1,900 miles of toll turnpikes currently in operation, and the several controlled-access expressways constructed and operated by state highway departments, have demonstrated the need for a new concept in signing divided-roadway, controlled-access expressways, and these modern facilities are the laboratories or proving grounds that are supplying the research information needed for proper signing in line with the peculiar needs of the modern freeway. The modern freeway is designed for and dedicated to the moving of long-haul express travel between traffic-generating urban centers and between highway systems. It is dedicated to the fast and safe movement of groups of vehicles instead of to the movement of individual vehicles and service to adjacent property. By reason of the proposed design standards, there will be a minimum need for caution and warning signs, and no need for stop signs and railroad crossing signs on the Interstate System trafficways. The need is for directional, informational, and service signs. It will also be necessary in many instances to repeat such signs to be sure the motorist is properly informed.

Because of the effect on the motorist of driving long distances at high speed in high traffic densities, signs giving directions and information will have to be properly placed, legible at great distances, and instantly understood by all motor-vehicle operators.

To make highway facilities safer, geometric layouts, especially at interchanges, sometimes get very complicated. Directions for turning must be easily read and interpreted without causing confusion or delay in the traffic flow. Drivers must be told in advance of exit points, and must know on which side of the road the exit point occurs so that they will not be in the wrong lane for making the turn, as considerable extra travel may be involved if the turn is missed. All the needed signs cannot be placed on posts along the sides of the through-

way; some must be supported on overhead structures. There is need for an economical, mass-produced structure to support overhead signs. Many present overhead sign installations have been custom designed and constructed and are entirely too costly for the many applications that will be needed on the 41,000-mile Interstate System.

AASHO Committee to report

The AASHO has assigned the working out of all recommended expressway signing for the Interstate System, except for the distinctive route marker, to its Committee on Traffic. The group is studying signing practice on existing toll turnpikes and expressway facilities operated by the state highway departments, and is also working closely with the Joint Committee on Uniform Traffic Control Devices. It is expected that both the Route Numbering Subcommittee and the Traffic Committee will make their recommendations to the Executive Committee of the AASHO about July 1. Subject to approval and acceptance by the Executive Committee, the recommended comprehensive signing practice for controlled-access expressways will then be formally submitted to the Joint Committee for consideration and inclusion in the Standard Manual.

Recommendations will include standard overhead sign structures, signs that should be illuminated, letter size and shape, the proper use of lower and upper case letters, locations, colors, and sizes of signs. It is highly probable that several types of signs recommended by the Traffic Committee will be manufactured and installed under the auspices of the Bureau of Public Roads and the AASHO in various sections of the country and observed under various weather and light conditions before they are finally adopted. It is expected that a uniform Interstate signing practice will be in effect and use by late fall of this year.

It has been the recommendation of the AASHO Executive Committee that no state highway departments should install the signing adopted for the Interstate system on any section of the proposed system until a section between major control points on the system is completed to the proposed design standards and ready for traffic. This is so that the traveling public will associate the marking with the type of facility comprising the Interstate network.

It is definitely recommended that no state should install the distinctive Interstate route marker along a present route connecting Interstate control points with the idea of later transferring such a marker to a new Interstate expressway, as it would be extremely difficult, once a marker were erected, to move it to the new route. There would certainly be strong public and political reaction on the part of those using and owning commercial properties on the old route when they found the sign missing.

It appears that at least 75 percent of the 41,000 miles will carry the distinctive Interstate route marker on new location, and that the 25 percent of this mileage to be constructed on existing locations will be dually marked, that is, carrying the present route marking, whether state or U. S. shield, together with the new distinctive Interstate marker.

Through the United Nations an effort has been initiated to make highway marking uniform throughout the world, but as stated previously there seems little need for this development at present. Eventually, it probably will be accomplished, although not in the immediate future.

The Interstate System is focusing attention on the need for improvement in highway signing as no other development has in recent times. With three-fourths of the world's automobiles in the United States, giving this nation more experience in motor transportation than other countries, and with the construction of this 41,000-mile network pushing the United States still further ahead in the operation of modern highways, the work now being undertaken in developing highway signing practice may have a profound influence on world-wide highway signs and signals at such time as they may be standardized for global application.

Work of UN group

In 1949, the United Nations Conference on Road and Motor Transport initiated the development of a uniform world-wide scheme of highway signs. In 1950, a small group of experts in this field, representing six regions of the world, was named to propose steps to be taken towards uniform signing practice. This group met and considered the American and European patterns. The United States worked with this group, and is still interested in the overall objective, but in 1953 declined to sign or ratify the protocol on a uniform system for world-wide application. The two major reasons for the action of the United States are as follows:

First, all signing for traffic in the United States is the responsibility and prerogative of the various political subdivisions, and substantial uniformity of practice has been voluntarily achieved through the agency of the Bureau of Public Roads and the Manual on Uniform Traffic Control Devices for Streets and Highways. There is no single agency in the United States authorized to commit the nation to uniform signing practice.

Second, rapid changes are taking place in the United States in the unprecedented use of motor vehicles. Because of these changes, highway signing and marking must be subject to development and improvement, and the needed flexibility in this area would be impaired by adherence to any international code.

It seems that the action of the United States in not ratifying any world-wide signing practice has been sound, since the building of the Interstate network has pointed up the need for developing a new concept in highway signing. This need has developed within a relatively short time.

Although it has been the traditional philosophy in the United States that local units of government have the right to put signs and markers on the highways to direct the traffic passing through their jurisdictions, a mobile motoring public will create public opinion that will force more uniformity than has previously existed, especially on major arterial routes and on the Interstate system. If the states do not develop and adhere to a uniform practice in highway signing, and in enacting, interpreting and enforcing rules of the road, national control over signs and rules may result. With a nation on wheels, a sign must mean the same thing in every locality, and the rules of the road must have the same meaning and the same enforcement from coast to coast. The public welfare justifies such uniformity.

Courtesy "New York Motorist," March 1957

Master builders of Mesopotamia

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While ancient Egypt is generally thought of as the cradle of civilization, the engineer's early prototype, the master builder, was also taking part in what was perhaps an equally early rise from barbarism in the lands at the north end of the Persian Gulf. More or less encircling the northern edge of the huge desert peninsula of Arabia, a high and mountainous plateau formed what Breasted calls the "Fertile Crescent," a grassland area diagonally across which the Tigris and Euphrates cut their channels to emerge in a great flood plain as they empty into the Persian Gulf.

Here as in Egypt, early men found a prodigiously fertile soil, and over five thousand years ago were reclaiming marshes around the mouths of the two rivers and beginning to build settlements of low mud-brick houses much as the Egyptians were doing in the great delta of the Nile. Here the wheel appeared for the first time, for these agricultural people were not only grain growers but also herders owning cattle, sheep and goats as well as donkeys that pulled wheeled carts. But these pioneers of civilization did not possess the building stone which enabled Egypt to erect structures that still endure. They built with sun-dried brick, and their works had little permanence. Older structures were frequently leveled off to provide a base for later work, and until excavated were hidden in the formless mounds that marked the location of their towns.

Another difference was that their land was not isolated as was the Valley of the Nile by the great deserts on its borders. Mesopotamia was open to attack from the north, east, and west, and its history became a confused record of wave after wave of invasions by neighboring peoples. Such attacks usually ended with the attackers adopting a settled way of life, only in turn to fall prey to a new wave of invaders.

After the earlier development in the lower Plain of Shinar which became Babylonia, the center of interest shifts northward to Assur, a highland area with many fertile valleys running into the northern mountains, where small towns and cities developed and where there were occasional outcroppings of stone. The Assyrians established a great military empire for they faced other tribes to the west and north—the Hittites, Syrians, Phoenicians and others. The history of this rather late second chapter in the story of Mesopotamia lasted but a scant 150 years (750-612 B.C.). A third major period, that of the Chaldean Empire, was even shorter (about 612 to 539 B.C.) but was marked by the rebuilding of Babylon as the city of Biblical times.

This involved history plus the perishable nature of most of the works undertaken by these early peoples resulted in a long neglect of their history and accomplishments. Even when Xenophon and his ten thousand Greeks passed through about 44 B.C., Nineveh, the great city of Assyria, was a vast heap of rubbish. Only with the turn of the last century (1900) was the "scanty wreckage of the ages" unearthed in Babylon. We hear of the extensive drainage and irrigation works in this land but such works demand constant maintenance and apparently little remains today from which a connected story can be written.

Each of the three major periods in the history of this Land of the Two Rivers witnessed important advances in man's technical progress. We know little of the men who made these advances. As in Egypt, the initiative in such matters was in the hands of the governing group. The techniques involved were, after all, relatively simple, easily understandable, almost obvious, and the fundamental requirement was the ability to organize and direct hand labor rather than the involved procedures, highly technical tools, and special skills of today. Our major source of information is the multitude of records in the form of clay tablets which have been found and deciphered and which in cuneiform writing give us an insight into the life of these early days.

Hammurapi, King and Director of Engineering Works

The letters of Hammurapi, about 2000 B.C., reveal a busy governmental and engineering administrator actively directing the business of his office. He wastes no words in instructing his officials:

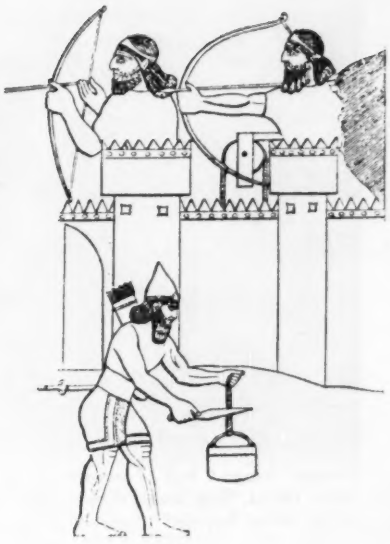
"To Sid-Indinnam, Hammurapi speaks as follows: Gather the men who have fields along the Damanum Canal to clear out the Damanum Canal. Within this month, let them complete the digging of the Damanum Canal."

The local officials undoubtedly had not only competent foremen to supervise actual operations but also technicians available for such work as required their aid. In the same period, 2000 B.C., clay tablets record land surveys in which areas were divided into rectangles and triangles.

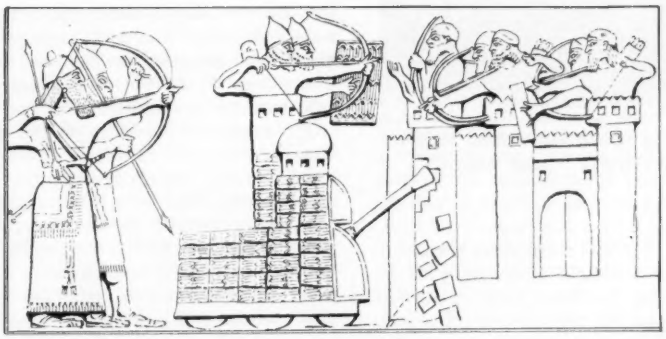
An angle measuring instrument, the astrolabe, had been devised. This instrument, unknown to the Egyptians, consisted of a graduated circle and a sighting arm. It was purely an astronomical instrument and long remained such, for surveying was destined to be purely "right-angle surveying" until quite modern times. Nevertheless we still retain in our angle and time measurements the 60-unit principle which characterized the ancient Mesopotamian numerical system.

The so-called Code of Hammurapi has also been described as the first building code. This famous legal document provides severe penalties for those who permit poor construction. It also conveys some hint of the crowded and difficult conditions in the ancient mound cities. It was here, in a land where

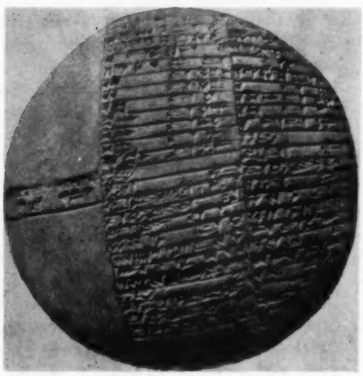
Initial letter reproduces cuneiform for builder, batu **(above), and building,** bitu **(below), as used in famous Code of Hammurapi as early as 2000 B.C. These symbols are supposed to have been derived from building plans.**



Relief, from Merckel, seems to prove that Assyrians were familiar with pulley and also with trowel. They did not, however, combine pulleys to produce a mechanical advantage as the Greeks did.



Military engineering made great progress during conquests of warlike Assyrians. Attack on a fortified city, using six-wheel battering ram with tower, is shown on relief of 885-860 B.C., from palace of Ashur nasir pal at Nimrud, now in British Museum.



Surveyor of 2400 B.C. recorded on a clay tablet the measurements and statistics for eleven fields. This cuneiform tablet, in unusual round form, from reign of Bur-sin, King of Ur, is now in British Museum.

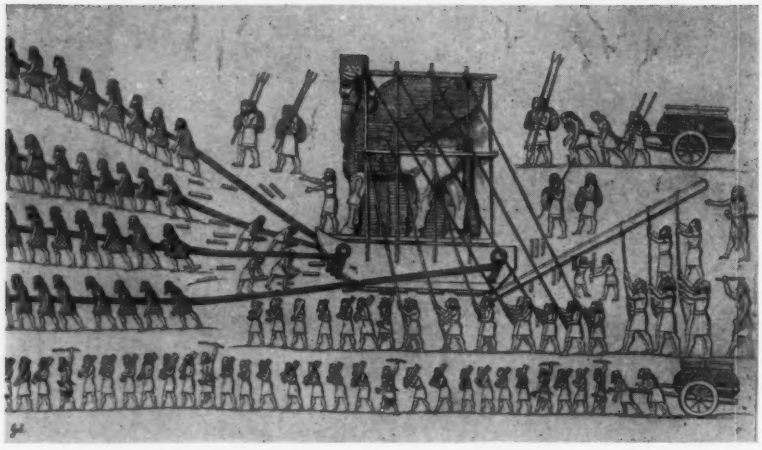
Engineering order of 2000 B.C. is from well known ruler, Hammurapi, to his governor, Sin-idinnam, who was in charge of work on canals in vicinity of Lagash. This clay tablet is in British Museum.

timber was scarce and no stone available, that one of the most important and fundamental structural forms appeared for the first time—the true arch. This true arch with its wedge-like ring stones is in contrast to the corbelled and cantilevered false arch, which consists of progressively overhanging horizontal blocks.

The true arch was known and used at least as early as 3000 B.C. in modest spans of 3 to 5 ft as a covering for drainage channels, which together with vertical risers, served to carry off the rain water of the mound city or town and also may have served as an early sewerage device. Both the Egyptians and the later Greeks knew the arch but with them it never became the important structural feature it became in Roman times. It is surmised that the Romans were introduced to the arch by the Etruscans who preceded them on the Italian Peninsula and are supposed to have brought this structural form with them in an early migration from eastern lands.

With Hammurapi's death the early Babylonian Empire declined, while Assyria, which emphasized the arts of war and conquest, began to take over. This rise of the Assyrians marked the birth of military engineering, which can be said to have begun under Tiglathpileser I, who came into power about 1100 B.C. After numerous setbacks and new conquests, the Assyrians brought this type of engineering to a peak of development about 745 B.C. under the fourth ruler of the same name, Tiglathpileser IV. Finally, in 670 B.C., even the ancient capitol of Egypt, Memphis, fell before Assyrian armies which had developed methods and techniques of warfare that were to prevail for centuries—until the advent of gunpowder in the late Middle Ages. Fortified towns, with walls, towers and moats, grew up. Fully developed battering rams, even light armored wagons, the prototype of the tanks of World War I, were employed, and pontoon bridges of inflated skins were used in crossing streams. The Assyrian archers, spearmen, shield bearers, horsemen and chariots became the scourge of the East, putting down rebellion with the utmost cruelty and disregard of human life.

It seems clear that the transportation needs of such an empire could not have been supplied, as they were in Egypt and Babylonia, solely by rivers or even canals. The extension of Assyria's influence and the consolidation of its vast conquests undoubtedly required the es-



Colossal winged bull is transported on sled by means of rollers. Note blocking under statue, also lever, carts loaded with rope, and forked sticks used to brace statue. From Layard, "Discoveries in Nineveh and Babylon," page 112.

tablishment of military roads with fortified stations and relays for communication, such as were used in Roman times. Therefore the Assyrians were probably the first road builders. As is the case with their drainage and irrigation works, the character and details of such works are unknown. It would doubtless be unreasonable to assume that any extensive grading or surfacing was undertaken.

It is in Assyrian history also that we find the first extensive use of iron. The Stone Age overlapped the early Age of Metal and even the practical use of the commoner metals—copper, bronze, lead and iron—was almost entirely confined to tools and weapons until the advent of the true Age of Iron in eighteenth century Britain. In any event, the Assyrian forces were the first large armies equipped with weapons of iron. A single arsenal room of Sargon's palace was found to contain 200 tons of such weapons. There is no indication that the Assyrians smelted this metal; they appear to have secured it from their western neighbors, the Hittites. The thirteen bronze bands about a foot wide and 8 ft long, from the doors of the palace of Shalmaneser III, in engraved and hammered relief, are also a remarkable example of early metal work.

While Babylon is sometimes referred to as the City of Brick, Nineveh, the Assyrian center, is spoken of as the City of Stone. As a matter of fact, brick was an important and common building material throughout all early times as it is today. But stone was available to the northern cities, and large slabs of alabaster in particular were used for special buildings. The colorful pioneer archaeologist in this area, Layard, over a century ago uncovered interesting reliefs which show the transportation of sculptured blocks by methods similar to those used in ancient Egypt, plus the effective use of rollers. But the largest of these blocks probably did not exceed 40 or 50 tons, far less than the weight of those handled by the Egyptian master builders.

Sennacherib and the first public water supply

To the civil engineer one of the most interesting works of Assyrian times is the Aqueduct of Jerwan of 691 B.C. Although built both for irrigation and for domestic use, it is regarded as the first notable example of a public water supply. In earlier days canals and ditches served not only for irrigation (and in Mesopotamia at least, for transportation also) but were the principal sources of public water supply. Then under King Sennacherib an aqueduct was built which carried—instead of the usual turbid canal water—cool, clear mountain water from the hills of Mount Tas to Nineveh. A rock carving near the headworks records:

"To the great Gods the King prayed and they heard his prayer; they directed the work of his hands. By gates and a tunnel the sluices opened of themselves and permitted the rich water to flow down; it needed not the strength of the sluice people to open itself. According to the wishes of the God's heart, he had dug the water, carried it from the stream, and directed its force. The Gods who aided in the work were rewarded with great sacrifices; the men who dug it were clothed in colored garments and granted rings and bracelets of gold."

Careful studies have fortunately been made of this great work, showing a truly remarkable series of structures and at the same time throwing an interesting light on the civic works undertaken by Sennacherib. He seems to have been a progressive municipal engineering director and to have had a genuine interest in such improvements, an interest which may have been stimulated by the revolutionary town planning evident in the work of his father Sargon II at Khorsabad, north of Nineveh and on the line of this water supply. Some 30 miles long, this system added to the King's earlier constructions, indicating, it might be noted, that the problem of seeking additional water supplies to meet population growth and increased use has presented a challenge to ancient as well as to modern municipal engineers.

The outstanding feature on the line was an elevated cut-stone structure which carried the open canal over a small stream. This is "a type of structure which nowhere else survives from pre-Roman times." It provided a channel over 50 ft wide and probably 5 ft deep, dimensions which dwarf the narrow *specus* or channel of the Roman aqueducts of which it is the prototype. This structure, some 920 ft long, was divided into 14 bays by buttresses about 50 ft on centers. It had a maximum height of about 30 ft and was carried over the stream on five spans, each about 8 ft long and 16 ft high. Round cut-waters were provided on both upstream and downstream ends of piers.

It is to be noted that, even in this rather late structure, the high, pointed arches were still false or corbeled. The cut stones were apparently much of a size (20 by 20 in.) and were laid in parallel lines with no "headers" in evidence. Although "headers" are found in Sargon's palace at Khorsabad, it seems clear that in both Egyptian and Assyrian brick and stone work these "wall binders" marked the rare exception rather than standard practice as followed by the Greeks. The mortar used was lime and it is said by modern excavators that it was "not as yet fully carbonized" where used in the form of lime-sand-limestone concrete 16 in. thick under the channel paving.

Nebuchadnezzar, rebuilder of Babylon

The final or third chapter in the story of this ancient land witnessed the rebirth of Babylonia under the Chaldean Empire. The Chaldeans, originally a Semitic tribe of desert nomads, rebuilt Babylon after Sennecherib had completely destroyed the ancient city of Hammurapi—having lost patience after its repeated attempts at revolt. Modern excavations have failed to uncover any remains of the older city,

and it is the Babylon of this later period that is usually referred to.

The noted Greek historian Herodotus visited and was deeply impressed by the vast and gorgeous palaces and other features of this new city which had been reborn over a century before under Nebuchadnezzar of Biblical fame. Nebuchadnezzar's structures surpassed in splendor the great buildings of earlier days, and Herodotus was also deeply impressed by Babylon's fortified walls and other marvels. Most of its structures belong more properly to the domain of art and architecture than to engineering. Among them were the still mysterious Hanging Gardens which the Greeks numbered among the Seven Wonders of the World. Today little remains of these famous terrace gardens, and their supposed ruins are said to be rather unimpressive and disappointing. Yet in spite of these structural marvels and some advances made by Chaldean astronomers and astrologers, the kingdom founded by Nebuchadnezzar proved to be a short-lived episode in history, lasting only some 70-odd years (621-539 B.C.). Other, more active and progressive peoples soon took up the burden of leadership.

Sennacherib's Aqueduct of Jerwan, built in 691 B.C., brought clear mountain water to Nineveh, probably first really adequate municipal water supply. No other structure of this type survives from pre-Roman times. Note uniform size and uniform placing of great stone blocks in this structure which provided an open channel some 50 ft wide and 5 ft or more in depth. Photo courtesy of Oriental Institute, University of Chicago.

In summary

We can only regret that the names and personalities of those who were directly concerned with the carrying out of the constructions of Hammurapi, Sennacherib, and other rulers, and of those who invented the devices used in those early days, have not come down to us. Still hidden in the ruins of this ancient world are no doubt interesting reminders of the early workers in our profession who pioneered in developing not only the arts of war but also the essentials of a settled, civilized, urban way of life. One has the feeling that in Mesopotamia the impact of engineering on an entire people was far greater than in ancient Egypt. It would appear that a far larger segment of the people—the merchants and business men at least—enjoyed the civilizing results of the activities of the early master builders.

It is always difficult, even in modern times, to attribute an invention or a notable technical advance to any one man. Many others may have played a part in preparing the way. Mesopotamia unquestionably added a number of notable rungs to the ladder of engineering progress. In civil engineering there were the arch, the first great public water supply, and probably the first road building; in military engineering, the fortress, the battering ram, the first extensive use of iron (for weapons) and the development of planned military tactics; and in mechanical engineering, the single-sheave pulley. Only by their works can we know the ancient engineers who invented and practiced these engineering arts.

Furthermore these early and important advances were probably more or less lost to the world and had to be rediscovered by other peoples in later times. The reign of Nebuchadnezzar (561 B.C.) marked the high-water mark in the Chaldean rebirth of Babylonia. Soon the Medes and Persians, two powerful tribes belonging to a western branch of the same parent stock from which we are descended, obtained the upper hand. Nineveh had fallen in 612 B.C., and the great Persian leader Cyrus captured Babylon without a battle in 539 B.C. His son Cambyses later conquered Egypt, and the Persian Empire, which endured for some two centuries, turned its face westward to harass the Greeks, now about to take over the torch of Western civilization.

Darius the Great (521-485 B.C.) restored the Nile-Red Sea Canal of the Egyptians, apparently filled up long before. One of his inscriptions reads:

"I command to dig this canal, from the stream flowing in Egypt, called the Nile, to the sea which stretches from Persia. Then this canal was dug as I commanded, and ships sailed from Egypt through this canal to Persia, according to my will."

The Persian emperors maintained communication, it is said, by excellent roads throughout the vast empire they attempted to bind together, an attempt which emphasizes the role of engineering in government and reminds us of the later reliance of Rome on highways to consolidate its far-flung empire.

After 400 B.C., Persia gave way to Greece. The Ancient Orient, the Near East, lost its position of cultural leadership, after bequeathing to Western civilization a rich heritage in the practical as well as the ornamental arts. It had made unparalleled advances in construction as well as in architecture, had invented the alphabet, laid the foundations of literature, and developed weights, measures, and coinage. It passed on to Europe the beginnings of mathematics, astronomy, medicine, and government organization. The story of these ancient peoples covers more than half the span of recorded history and emphasizes the debt of the West to the East. It shows us also early stages in the development of the way of life we know today, advances only surpassed in importance by those of the past two centuries.

References

The pioneer work of Sir A. H. Layard, *Discoveries in Nineveh and Babylon* (London, John Murray, 1853) still is of interest. In addition to Breasted, several general histories are available including *The Civilization of Babylonia and Assyria* by Morris Jastrow (Lippincott Co., Philadelphia, 1915) and *History of the Assyrians*, by A. T. Olmstead (Scribners, New York, 1923).

There are, of course, many special publications such as *The Code of Hammurabi* by R. F. Harper (University of Chicago Press, 1904) and *Sennacherib's Aqueduct at Jerwan* by T. Jacobsen and S. Lloyd (Oriental Institute Publications, No. XXIV, University of Chicago, 1955).

I. Interceptors, pumping stations, force main, and plant

Miami high-rate activated sludge

E. SHERMAN CHASE and JOHN S. BETHEL, Jr., Members ASCE

Sewage Treatment Plant on north end of Virginia Key is connected with Miami (out of photo at left) by submarine pipeline of 72-in. diameter 2¾ miles long under Biscayne Bay. Conduit and ocean outfall can handle 153 mgd anticipated from 1980 estimated winter population. Miami Beach is at upper right, connected with Miami by causeways in distance.

TABLE I. Project was divided into five contracts

Contract	Structures	Contractor	Bid Price
No. 1	Interceptors	Blythe Bros. Co. & W. T. Price Dredging Corp.	$ 6,719,848
No. 2	Pumping stas.	DeFonce Constr. Co., Inc.	2,454,160
No. 3	Force main across bay	Merritt-Chapman & Scott Corp.	1,988,878
No. 4	Treatment plant	Paul Smith Constr. Co., Inc.	9,216,559
No. 5	Ocean outfall	Diamond Constr. Co.	1,677,461
		Total	$22,056,906

TABLE II. Original and final cost estimates

Item	Orig. Est. at Start of Work	Estimated to Completion
A. Land, easements, rights-of-way	$ 200,000	$ 191,300
B. Constr. costs incl. contingencies	24,156,906	23,083,100
C. Engineering	1,700,000	1,600,000
D. Legal and administrative	133,500	200,000
	$26,190,406	$25,074,400

plant in operation

Partners, Metcalf & Eddy, Engineers, Boston, Mass.

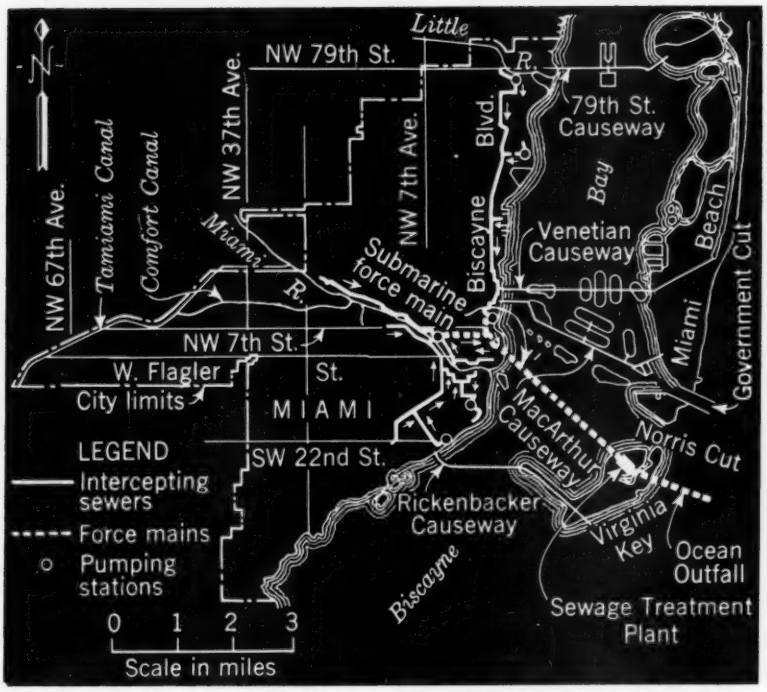


FIG. 1. Miami's new sewage disposal plant on Virginia Key has design capacity as built of 47 mgd, estimated average flow in winter of 1965. Flow capacity of grit chambers, conduits, and outfall is however 153 mgd.

Miami's pollution abatement program has at long last become an accomplished fact. Sewage was first pumped to the city's new activated sludge plant on September 18, 1956. The general features of the program were described by the senior author in the July 1953 issue of CIVIL ENGINEERING (pp. 40-42). Articles on the program were published subsequently in other journals. (See "Miami Breaks Ground for Sewage Treatment Plant," by Samuel T. Drew, *Wastes Engineering*, October 1953, p. 491; and "Miami's Virginia Key Sewage Treatment Plant," by John S. Bethel, Jr., *Sewage and Industrial Wastes*, March 1954, p. 241.)

Briefly, the program consisted of the construction of intercepting sewers, pumping stations, a force main across Biscayne Bay, a treatment plant on Virginia Key, and an ocean outfall. All these features are related to one another as shown in the map of the area above—Fig. 1.

Financing of the program has been by bond issues—$11,100,000 of sewer revenue bonds, and $16,000,000 of general obligation bonds. Preliminary engineering and detailed designs and specifications were paid for out of sewer revenues.

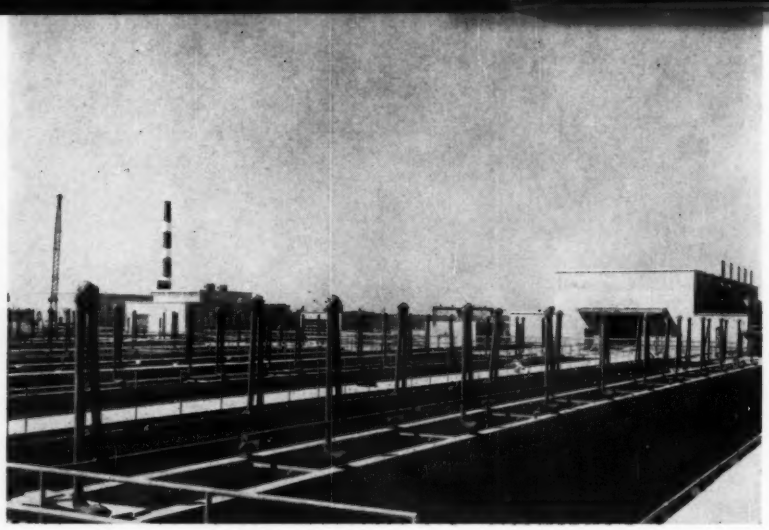
Construction bids were received in January 1953 but litigation held up the start of actual construction until the following August. In Table I are given the five main contracts, prime contractors, and bid prices. In addition to these main contracts there were three additional, relatively small contracts for the access road, water supply facilities, and storm shutters on certain buildings.

Final costs of the program have not yet been determined, inasmuch as the work is not quite completed. The total estimated costs of completing the work, in round numbers, are given in Table II and compared with the original estimated costs.

This account will deal but briefly with Contracts 1, 2, and 3 (Table I), as they covered work designed by Connell and Rader Associates, who also provided resident supervision during construction of these parts of the project. Construction of the intercepting sewers (Contract 1) made good progress in spite of the high ground-water level. Probably the most difficult job was the construction of the siphon under the Miami River, from the south side of the river to the 4th Street Pumping Station. Sewers through Miami's busy streets were laid with very little interference with traffic.

Pumping Stations

Under Contract 2, the small pumping stations were constructed without undue difficulty, but completion of the two large stations, "N.W. 4th Street" and "N.E. 9th Street," was considerably delayed by difficulties with ground water. The former station



Conventionally designed aeration tanks are equipped with swing diffuser assemblies that permit withdrawal of diffuser tubes for inspection and cleaning while plant continues in operation.

went into service on September 18, and the latter on November 2, 1956. The 4th Street Station is now receiving sewage from the city south of the Miami River and from a part of the city north of it. The 9th Street Station is receiving sewage from the remainder of the sewered northerly part of the city.

Because the operation of the pumping stations is related to the operation of the treatment plant, a brief description of them appears in order. All sewage reaching the treatment plant will be pumped by the two pumping stations located in downtown Miami, one east of Biscayne Boulevard, between N.E. 9th Street and N.E. 10th Street, and the other at the intersection of N.W. North River Drive and N.W. 4th Street extended. The immediate average sewage flow to each of these two stations was estimated to be 11.3 mgd and 11.6 mgd respectively, and the present maximum capacity is 41.5 and 54 mgd respectively. The future maximum capacity at the N.E. 9th Street Pumping Station will be 51 mgd, and that at the N.W. 4th Street Pumping Station, 102 mgd. Operation has been for so short a time that it is impossible to compare the present flows with those anticipated.

Each station is equipped with automatic, mechanically cleaned bar racks with 1¼-in. clear openings. Screenings are ground in two hammer-mill grinders at N.W. 4th Street and one hammer-mill grinder at N.E. 9th Street, each with a capacity of 2,500 lb of screenings per hour, and are returned to the sewage stream ahead of the bar racks.

Each station is also equipped with two chlorinators, with a capacity of 6,000 lb per 24 hours each, to chlorinate the raw sewage for control of odors, to prevent formation of slimes in the force main under Biscayne Bay, and to retard the decomposition of sewage in the force main.

Laying of the 72-in. precast concrete force main, approximately 14,400 ft in length, across Biscayne Bay (Contract 3), was completed expeditiously and without incident.

Features of Treatment Plant

The treatment plant has been designed to operate as a high-rate activated-sludge plant but is so laid out as to permit the adoption of either the "step-aeration" or the "biosorption" process if experience indicates it to be desirable. Because there are over 70 submerged outlets from the city's sewer system, it was not possible to obtain information as to the character of the sewage to be treated—hence the need for providing flexibility in the plant design.

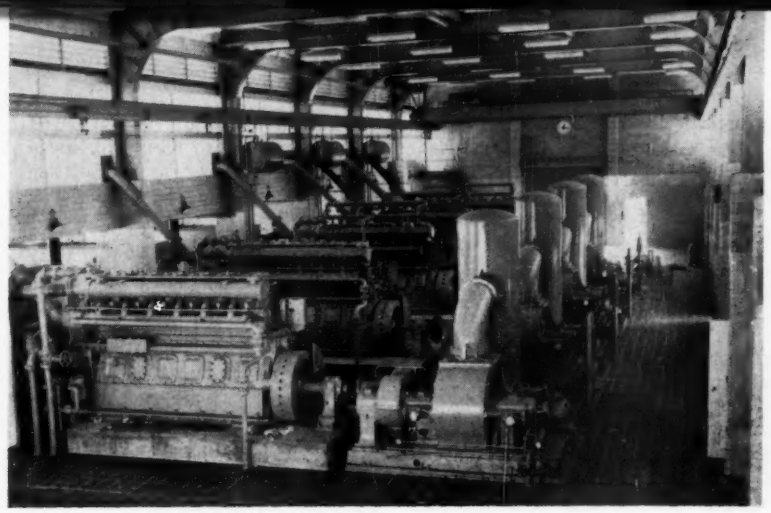
Since there was known to be considerable infiltration into the sewer system, it was evident that the sewage would be relatively dilute. Furthermore, on account of flat slopes and low velocities in the sewers, it was anticipated that the sewage reaching the plant would be rather stale, with a tendency to become septic. These two factors led to the decision to omit primary settling tanks ahead of the aeration tanks.

The design capacity of the treatment plant as now built is 47 mgd, which is the estimated average sewage flow in the winter of 1965. The grit chambers, conduits, and outfall are designed for a maximum flow of 153 mgd. The average winter flow in 1980 is estimated to be 68 mgd. This flow is 45 percent greater than the design flow of 47 mgd. Therefore space has been left for a 50-percent increase in secondary treatment and in sludge disposal units, including aeration tanks, final settling tanks, blower facilities, sludge concentration tanks, sludge digestion tanks, and vacuum filters.

No provision has been made for increased grit-removal facilities because these units are designed to handle the maximum flow of 153 mgd. Also, no provision has been made to increase the sludge elutriation facilities because the present tanks should be adequate to treat the increased sludge volumes. Nor has any provision been made to increase the incinerator capacity because the second furnace, which is now installed, will serve essentially as a standby during the first years of operation, and can be used to burn the increased sludge load in the future.

The influence of the tides on design should be mentioned. As the tide in the ocean rises, the water level in the effluent channel of the final settling tank will rise correspondingly. Thus, for any given tide elevation, there is a sewage flow which, if exceeded, will submerge the weirs of the final settling tank. It is possible, however, to treat 153 mgd during all tides except hurricane tides. During ordinary hurricanes it should be possible to treat flows up to 130 mgd before the plant must be bypassed.

All buildings that cannot be flooded during hurriance tides are designed to resist flotation with the tides at El. 9.0 (city datum). However, tanks or other structures capable of being flooded are designed to resist flotation with tides at El. 3.0. For tides in excess of this elevation, filling of the tanks or structures with water or sewage will be



Four engine-driven rotary blowers each provide 10,400 cfm of air for aeration tanks. Two of these engines can utilize either diesel fuel or sludge digestion gas, or both in any proportion; two use gas only.

required to prevent possible structural damage.

Grit chambers and grit building are located where the sewage enters the treatment plant. After passing through the 72-in. reinforced concrete force main under Biscayne Bay, the sewage is discharged into the inlet channel of the grit chambers, where provision is made for chlorinating it. The sewage then enters two aerated grit chambers, where it is anticipated that all the 100-mesh grit will be removed at all flows up to 153 mgd. Flow through the chambers is spiral, a pattern that is maintained by the use of removable air diffusers. Air is furnished by three variable-speed positive-displacement blowers installed in the equipment area in the basement of the grit chambers. These blowers furnish a maximum of 6.3 cu ft of air per lin ft of tank with all three blowers and two tanks in operation, and a minimum of 0.6 cu ft of air with one blower and two tanks in operation.

The grit, from which organic material will have been separated, is deposited in a trench beneath the aeration tubes, from which it is elevated into the grit building and then discharged to pneumatic grit ejectors by bucket grit collectors and elevators. The capacity of the grit removal and elevating equipment is 90 cu ft of grit per hour per chamber, which is sufficient to handle 28 cu ft of grit per million gallons of raw sewage.

One grit ejector is provided for each grit chamber, each ejector having a capacity of 50 cu ft. Each ejector can be operated once each half hour, making the capacity of each ejector equivalent to 100 cu ft of grit per hour. A warning device at each ejector will sound when the ejector is full and ready for discharge. The ejector discharge is controlled manually. Compressed air in the ejector is under a pressure of 75 psi. Grit is conveyed by the air from the ejectors through cast-iron pipe to a grit dump located at the northwest corner of the plant property. If required in the future, the grit can be discharged to a future overhead storage bin for subsequent removal by truck.

Compressed air for the ejectors is supplied by two two-stage reciprocating compressors and two 235-cu ft air storage tanks. The compressors are rated at 81.8 cfm, 900 rpm, and 100 psig (lb per sq in. gage). Two pumps for dewatering the grit chambers are located in the tunnel between the two chambers.

Parshall flumes located at the effluent end of each grit chamber measure the sewage passing through each of the two chambers. The flumes also serve to control the water level in the grit chambers. The width of the throat of each flume is 60 in., and the upstream head on each flume will vary from 0.55 ft at 5 mgd to 3.0 ft at 76.5 mgd.

Aeration tanks are four in number. Under present conditions, the sewage flows through the Parshall flumes to the aerated influent channel of the four aeration tanks through two pressure conduits. Each conduit consists of two sections, 5 ft 5 in. by 4 ft, and 3 ft 5 in. by 4 ft respectively. These dimensions permit the maintenance of self-cleansing velocities in the conduits since that conduit is used which has the appropriate cross-section for the particular flow being routed.

The aeration tanks are arranged so that they can be operated as a single battery of four tanks or as two batteries of two tanks each. If the tanks are operated as two separate batteries, each battery will receive return sludge only from its separate battery of final settling tanks. This can be accomplished in a distribution box at the influent end of the aeration tanks. Return sludge is discharged into the aerated influent channel at the point where the pressure conduits discharge into that channel or into the head of the first pass of each tank.

Each tank is divided into three passes, each pass being 22 ft wide by 210 ft long by 13 ft in water depth. The hydraulic gradient is controlled by a weir plate at the end of the last pass over which all the mixed liquor must pass. The piping at each tank is so arranged that any proportion of unaerated mixed liquor or raw sewage may be discharged to the head of the first pass or to the end of the second pass. Such an arrangement will provide the means to operate the plant as either a "biosorption" plant or a "step-aeration" plant.

The aeration tanks are conventional spiral-flow tanks using "swing" diffuser assemblies which permit withdrawal of the diffusers from the tanks for inspection and maintenance while the tank is in use. Diffusers are Saran wound tubes with a normal capacity of 6 cfm of air per tube. Air is applied to the influent and effluent channels of the aeration tanks at a rate of about 6 cfm per lin ft of channel, and to the main tanks at a rate of about 12.4 cfm per ft of channel. A total of approximately 6,750 tubes are required in the aeration tanks. Design data for the aeration tanks are given in Table III.

A system of foam control is installed on the second and third passes of

TABLE III. Design data for four aeration tanks

MISCELLANEOUS	
Design flow, mgd	47
Tanks, number of	4
Passes, each tank	3
Width of each pass, ft	22.0
Length of each pass, ft	210
Average depth	13.0
Capacity, total, cu ft	720,000
Tank length, ft	2,520
Tank surface area, sq ft	55,400
B.O.D., lb per day	56,000
Detention of raw sewage at av. flow, hours	2.75
Return sludge to aerators, percent	4
Preliminary settling tanks	None
AIR	
Installed capacity, cfm	41,600
Used, cfm	31,200
Cu ft per gal of raw sewage	0.97
Cu ft per lin ft of tank	12.4
Cu ft per sq ft of tank	0.56
Cu ft per lb of B.O.D.	800
B. O. D.	
Lb per 1,000 cu ft of tank	78
Ppm removal in plant	123
Cu ft of air per gal of raw sewage per ppm of B.O.D. removed in plant	0.0078

each aeration tank. This system provides for a series of high-velocity sprays discharging along a plane parallel with the longitudinal wall of the tanks. This spray is directed against the water at the walls opposite from the air diffusers. Water for this system is final effluent which has been strained through an automatically cleaned strainer with 1/16-in. openings.

Final settling tanks are four in number. Mixed liquor is discharged from the effluent channels of the aeration tanks to the aerated influent channel of the final settling tanks through two pressure conduits identical in section with those between the Parshall flumes and the aeration tanks. The final settling tanks are arranged to operate as a single battery of four tanks or as two batteries of two tanks each. In this respect, they are similar to the aeration tanks.

Aerated mixed liquor enters the settling tanks through 20-in. square sluice gates. Six of these influent gates are provided on each tank. These gates are operated by a wrench through gate boxes in the concrete deck slab. A vertical wooden baffle placed in front of each gate dissipates forward velocities. A horizontal concrete baffle beneath the gates prevents scouring of sludge from the sludge hoppers.

Each tank consists of three longitudinal channels, each channel being 18 ft wide by 265 ft long by 11 ft in water depth. A cross channel 10 ft wide is located at the influent end of the longitudinal channels. All channels are equipped with conventional chain-and-flight sludge and scum-removal mechanisms driven by separate motors. Sludge is moved into a single sump at the influent end of each tank, whence it is pumped by sludge withdrawal pumps.

A sludge pumping station is provided for each two settling tanks. Each pumping station contains three centrifugal sludge withdrawal pumps and one dewatering pump. One sludge withdrawal pump will normally take care of one final settling tank, the third pump acting as a spare. The capacity of each pump can be varied between 300 to 1,800 gpm by means of a variable-speed drive. These rates of sludge withdrawal are equal to 4 to 22 percent of the design raw sewage flow, respectively.

Scum is conveyed by the return run of the sludge conveyors to a scum trough located approximately 175 ft from the inlet end of the tanks and is moved into the trough by means of helical skimmers. The scum is flushed from the trough into scum ejectors by final effluent obtained from the tank. Two pneumatic scum ejectors are provided to transfer scum to the sludge digestion tanks. Each ejector has a capacity of 150 gpm and is automatically discharged when full. Air is furnished by two 75-cfm compressors and an 80-cu ft air-storage tank.

The final effluent overflows at the effluent end of the tanks over notched weirs having a total length of 3,160 ft, thus giving an average weir rate of 14,800 gal per lin ft per day. To prevent loss of fine sludge particles, which may be carried by density currents up the wall at the effluent end of the tank, no weirs are located in the last 20 ft of the tank.

The tanks may be dewatered by opening sluice gates at the effluent end of the tanks, thus permitting the water level in the tank to fall until the water levels in the tank and in the final effluent channel are balanced. The gates can then be closed and the remaining liquid removed by the centrifugal dewatering pump or by the sludge-withdrawal pumps. The dewatering pump in the south sludge pumping station also can be used to dewater the 108-in. plant bypass pipe.

Return and waste sludge is pumped from each pumping station at the final settling tanks through separate 16-in. pipes to the distribution box at the influent end of the aeration tanks. The pumps provided for this service are the sludge withdrawal pumps referred to previously. The volume of sludge returned, which includes both return and waste sludge, is metered by venturi meters.

The distribution box is so arranged that it is possible to return all sludge to the aeration tanks, to waste all sludge to the concentration tanks, or to divide the sludge between these two units in any proportion desired. This flexibility can be obtained by means of adjustable weirs. The distribution box also receives the discharge of the overflow pumps in the pumping station for the sludge concentration tanks and returns it to the aeration tanks.

Chlorination is applied at several points in the plant. The final effluent, after passing over the weirs of the final settling tanks, flows to an open chamber where chlorine in solution is applied. The chlorinated final effluent then flows through the outfall, in which the detention period, at a flow of 153 mgd, will be approximately 22 min.

Provision has also been made to add chlorine to the raw sewage as it enters the plant in the inlet channel of the grit chambers. Because of the short contact period in this channel, namely 17 sec at average flow and 10 sec at maximum flow, little reduction in bacterial content of the raw sewage can be expected. However, because of the rapid rate of reaction between chlorine and hydrogen sulfide, any hydrogen sulfide in the raw sewage should be removed before the sewage enters the aerated grit chambers. Hence prechlorination will be of value for the reduction of odors.

Connections are made into the two return sludge pipes to chlorinate all sludge returned from the final settling tanks. Chlorine applied at this point will assist in the destruction of fungi or other growths which may cause difficulty in operation of the activated sludge process. It is also possible to chlorinate only the waste sludge before it is concentrated in the sludge concentration tanks. It is anticipated that the waste sludge will be held 24 hours in these tanks. As a result of the long retention period and the high temperature of the sludge, some decomposition of the sludge solids must be expected, and to control it chlorine may be required.

A connection has also been made into the suction side of the flushing water pumps in the chlorination building for slime control in the flushing water system. In addition, provision is made for chlorination of both the influent and the effluent of the water treatment facilities, as will be described later.

Cylinders containing 1 ton of chlorine each are stored under cover outside the chlorination building. Space is provided on two storage racks for storage of 32 cylinders. Chlorine cylinders are moved from the rail head to the

chlorine storage area by truck, are lifted from the truck by an electrically driven monorail hoist, and are placed in storage. Empty cylinders are returned to the rail head by the reverse procedure.

Full cylinders are lifted from storage and placed on one of two platform scales. Each scale holds two cylinders of chlorine. Liquid chlorine from these cylinders is fed into two chlorine evaporators with a capacity of 6,000 lb per 24 hours each, where the liquid chlorine is converted into gas. The chlorine gas next passes through pressure regulating valves and thence into the chlorinators. Two pressure regulating valves and five chlorinators are provided. Three of the chlorinators have a capacity of 3,000 lb per 24 hours, one has a capacity of 400 lb per 24 hours, and one has a capacity of 200 lb per 24 hours. The three large chlorinators are arranged for manual control, for automatic control in proportion to the flow of sewage, or for automatic control by means of a predetermined program. The 400-lb chlorinator is manually controlled and is used only for chlorination of the flushing water. The 200-lb chlorinator is interlocked with the water treatment influent pumps.

The three large chlorinators are of the air-operated solution-feed type; the 400-lb unit is of the manually controlled solution-feed type, and the 200-lb unit is of the semi-automatically controlled solution-feed type. All units discharge chlorine solution into rubber-lined pipes leading to the various diffusers.

Alarms, provided at the chlorinators, will warn personnel if the temperature of the evaporator is too low, if the chlorine gas pressure reaches a predetermined minimum, if the injector water pressure reaches a predetermined minimum, or if the vacuum or pressure on the chlorine control valve falls below a predetermined value.

Water for operation of the injectors is strained final effluent from the sewage treatment plant. Water for the tray seals is fresh city water.

A bypass is provided around all units of the plant. At the grit chambers it is possible to bypass sewage around these two units through a separate channel between the two chambers. The sewage can then be discharged into reinforced concrete bypass pipe of 108-in. diameter. This bypass connects the effluent end of the grit chambers with the plant outfall. In addition, a connection to the bypass pipe is provided at the influent end of the final settling tanks so that the aeration tanks can be bypassed if such a procedure is desired.

Blower equipment is provided to supply air for the aeration tanks. Four blowers are installed in the blower building and space has been allowed for two additional ones. Air for the aerated grit chambers is provided by three small blowers located at the grit chambers. The four large blowers are of the positive-displacement rotary type, each with a capacity of 10,400 cfm of air at a discharge pressure of 7.5 psig. The blowers are fitted with separate inlet silencers and integral discharge silencers. They discharge air into a 48-in. steel pipe.

The air is filtered before it enters the blowers by a system consisting of an automatic viscous filter followed by dry-unit filters contained in a single filter housing. There is one filter unit for each blower. Each filter has a capacity of 11,800 cfm at not more than 0.57-in. pressure drop.

Each blower is driven by a separate non-supercharged four-cycle engine having a maximum speed of 514 rpm. Two engines are of the spark-ignition type and use as fuel the gas obtained by digestion of the sewage sludge. The other two engines are dual-fuel engines and operate on gas or diesel fuel in any proportion. The adjustment of the gas-diesel fuel ratio is automatically controlled by the engines.

The engines are started by a separate starting-air system. An electric-driven and a gasoline-driven compressor provide the air supply. Two 100-cu ft air storage tanks are furnished.

The two spark-ignition engines, and one of the dual-fuel engines, are equipped with waste heat boilers used as part of the engine-jacket water cooling system. Three circulating-water cooling systems are provided for: (1) engine-jacket cooling water, (2) lube-oil cooling water, and (3) sludge heating water. Excess heat is dissipated in seven horizontal-core fan-cooled, radiator-type cooling units. Heat for the sludge heating water system is obtained from heat exchangers on the jacket cooling-water system.

A fuel-oil cleaning system consisting of a filter and strainers has been installed. Operation of the engines requires filling a 200-gal tank at each dual-fuel engine from underground fuel oil tanks by means of two 15-gpm rotary-gear pumps. A lubricating-oil cleaning system filters dirty oil, removes carbon, sludge, and abrasives, and neutralizes any acids in the oil.

Controls on each engine will shut it down in case of overspeed, high lubricating-oil temperature, low lubricating-oil pressure, high jacket-water temperature, or low jacket-water pressure. Controls on the blowers will shut them down in case of low lubricating-oil pressure.

Air diffuser tubes will be cleaned in two steps. First, the tubes will be cleaned in place on the headers by use of a portable cleaning jet with ⅛-in. orifices. This jet resembles a doughnut with the orifices located on its inner surface. This "doughnut" can be slipped over each tube to wash off all loose material on the outside of it into the tanks. This operation will take place at the aeration tanks and will not require the removal of the tubes from the air diffuser headers. It will be performed periodically and as required to reduce temporarily the pressure loss through the tubes.

As a second step, the tubes will be completely cleaned when the pressure drop through them is approximately 24 in. of water. The pressure drop through them when they are new and passing 8 cfm of air will be approximately 14 in. of water. Tubes requiring complete cleaning will be first washed with the portable doughnut jet, and dried by leaving them on the header, above water, with a small amount of air passing through them.

They will then be removed and placed in one of the four soaking tanks and covered with a warm 3-percent (by weight) detergent solution. Soaking-tank capacity is provided for 600 tubes, which represents about 10 percent of the total tubes installed. Tubes will be soaked overnight while the tank contents are constantly recirculated and heated. After soaking, the tubes will be removed from the solution, drained, and washed in the high-pressure cleaning jet. Two of these jets will be installed and will wash the inside and outside of each tube simultaneously with fresh water at a pressure of 100 psig.

Any tubes bearing an iron or mineral deposit will then be dipped in a 10-percent hydrochloric acid solution and rewashed in the jet. Out of each batch (150 tubes), one or two tubes will be selected for test in the tube tester to ensure that the cleaning has been adequate. The liquid contents of the soaking tank will then be dropped to the transfer tank for storage until it is again required. Sludge remaining in the bottom of the soaking tank will be flushed to waste. It should be possible to reuse the detergent solution three or four times before it is discarded, but strengthening with new detergent may be required. After cleaning and testing, tubes will be placed in a storage rack until needed.

(In Part II of this article, to appear next month, the authors tell how the sludge is concentrated, digested washed, dried, and burned. They also describe the use of digestion gas for power and how the plant and ocean outfall were constructed.)

Electronic computers speed up bridge design

Employers and supervisors in many branches of civil engineering are turning to the new high-speed computers for faster and more efficient ways to do many time-consuming or repetitive operations.

To help cope with a large highway building program, the California Division of Highways turned to electronic computers more than a year ago for the computation of earthwork quantities and traverses. In May of 1956 a magnetic-drum data-processing machine was installed and work transferred to this new high-speed digital computer. For a discussion of these uses, see "Electronic Computers Save Time on Traverses and Earthwork," by Sam Osofsky (CIVIL ENGINEERING, November 1956).

Before the installation of this machine, F. W. Panhorst, M. ASCE, Assistant State Highway Engineer, Bridges, directed the writers to study the possibilities of utilizing these computers to relieve engineers of routine calculations. The first phase of this study was familiarization with the operation of computers in general and methods of preparing problems for solution. One effective way to do this is to attend courses given by manufacturers for users and potential users of their equipment. Next, procedures in the bridge design section were analyzed to find operations that are time consuming and repetitive, and susceptible to step-by-step breakdown in a form acceptable to the computer.

High-speed computer "remembers"

The desk calculator, which is a digital computer, and the slide rule, which is an analog computer, will continue to be important time savers in the design office. However a new, broader concept of what modern high-speed computers can do in solving problems and processing data promises big dividends to those with imagination and know-how. A desk calculator or slide rule solves a problem because the engineer guides it every step of the way. For a repeat performance, the engineer is again needed to do the thinking, and even if the same type of problem is repeated many times, the desk calculator and the slide rule gain nothing from the repetition.

On the other hand, the new high-speed computers have the ability to follow and remember instructions and can store data within themselves. A typical instruction tells the machine by means of a numerical code, first, what to do, such as add or subtract; second, where to find the information to be processed; and third, where to find the next instruction. This instruction would probably tell the machine what to do with the answer it obtained in the previous step, where to put the result, and where to find the next instruction. In effect, the machine can be prepared for a problem by loading a step-by-step solution into it. This detailed solution, or program, is stated in language the machine can understand and is prepared in a form the machine can accept, such as punched cards, punched tape, or directly by typewriter.

The important steps in the initial preparation of a problem type for solution are shown in Fig. 1. There the statement of a column-design problem is followed by the flow diagram which shows how the machine operations will fit together. The subdivisions of the flow diagram are then translated into a list of operation codes which become the program. Once a program has been designed and tested, it is available to solve any number of problems of that type in the future. As the library of programs grows, the usefulness of the computer also increases.

Many types of problems solved

The computer is a versatile machine which can solve problems of many types. It solves for the design of composite beams by successive trials, just as the engineer does, but with incredible speed. The engineer selects or computes the basic elements, as indicated in Fig. 2. The computer does the rest. One trial, which includes all the computations for section properties and stress and weight calculation, is performed in 2 seconds. A final solution for a girder section is obtained in about 3 or 4 trials, a total machine time of about 8 seconds compared to 30 minutes or more by manual methods. After the final section is determined, the computer solves for points of flange reduction, dead and live-load deflections, and shear factors for spacing of shear connectors. Total machine time for a complete design is about 14 seconds.

The computer also solves bridge geometry problems for combinations of unknown sides and bearings. In the detailed program which the computer follows, functions and angles are expressed in series form, and the machine computes very rapidly the sines and cosines of any angle to nine decimal places. Reference to tables and use of desk calculators—steps that consume time and produce errors—are eliminated.

A layout problem frequently encountered on curved alignment is shown in Fig. 3. Another layout problem, which occurs often in field location work where a base line is used to locate key points, is given in Fig. 4. The forms accompanying these figures are used for transmitting the necessary data to the computer section and for reporting the answers. This type of problem is readily susceptible to solution by computer.

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Complicated expressions involving many variables are solved quickly and easily. The expression for stress in a reinforced concrete column subject to two-way bending and axial load, shown in Fig. 1, involves, by usual methods, laborious trial solutions. The computer, however, makes a trial solution in 20 seconds, adjusts its data and solves again, and in about 3 or 4 trials produces correct answers for concrete and steel stresses. All this is accomplished in about one minute of machine time.

Problems that are not repetitive can often be solved economically. Part of the computations for the torsional stiffness of a suspension-bridge tower are given in Fig. 5. The 12 equations shown must be solved to determine the properties of one tower cross-section. The machine does the job in about 30 seconds and could solve for as many as 42 unknowns if necessary. Very few engineers would care to compete with a computer in this type of problem. For this solution a previously prepared program, a sub-routine, was provided from the manufacturer's library to make the usual detailed programming task unnecessary.

The ability of the computer to do routine arithmetical operations, such as multiplication of several quantities, addition and segregation into groups, and other combinations of operations, should not be overlooked. In our office we are using the machine for extending, summarizing, and listing reinforcing steel quantities, and recently have extended the service to all quantity calculations by means of a standard computation program. The results are increased speed, elimination of many sources of error, and transfer of valuable engineering man-hours to more productive work.

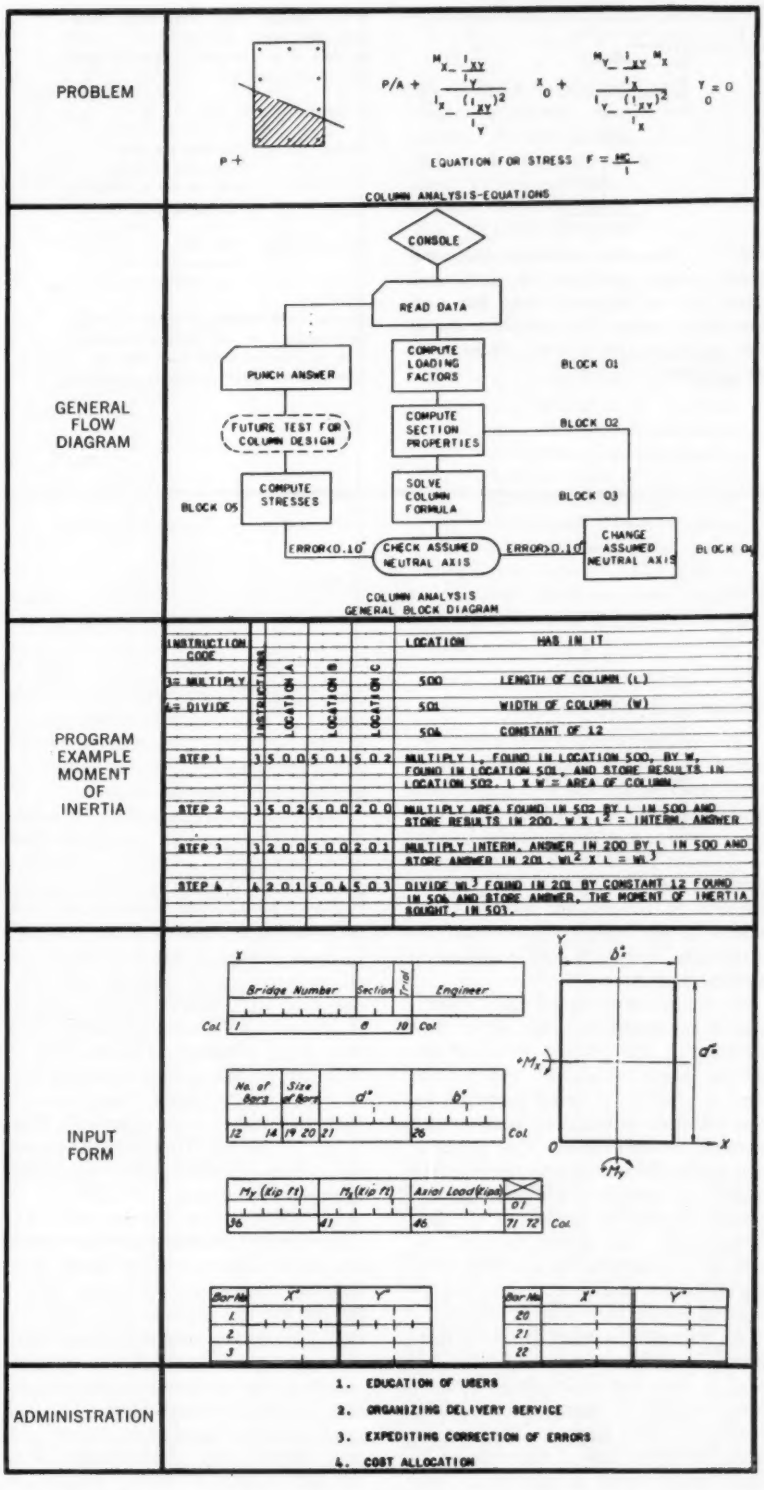


FIG. 1. Initial steps required in preparing a problem type for solution by electronic computer are illustrated by column-design problem involving axial load and two way bending. In 20 seconds after data are inserted, machine gives correct answers for concrete and steel stresses.

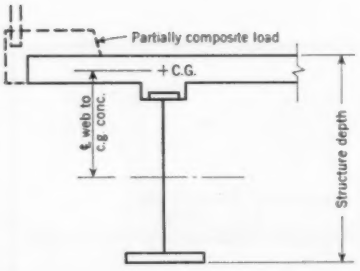


FIG. 2. Computer solves composite-beam design problem by successive trials just as engineer does, but with incredible speed. This problem shows how engineer selects basic elements to be inserted in machine.

THE ENGINEER SELECTS OR COMPUTES:

1. The design span, maximum allowable steel stress, and dead-load weight per foot of any partially composite loads such as curb and rail.

2. Either: Or:

Girder spacing — Live-load moment; Total area of concr.; Area of concr. effective for composite action

Structure depth — Web size; Distance from Web to centroid concr.

Several combinations of these data can be submitted to suit various conditions, such as structure depth and web size to match other girders already designed.

THE MACHINE COMPUTES AND REPORTS:

1. Size of top and bottom flange plate by thickness, width, and area.

2. Web size.

3. Weight per foot of girder steel for comparison.

4. Points of flange reduction.

5. Slab thickness and reinforcement if girder spacing was given.

6. Deflections under girder, deck, and live load.

7. I/Q of composite section for shear connectors.

Interesting future possibilities

The future promises many interesting applications in bridge design, structural analysis, and the civil engineering field in general. With a little help from the engineer, computers should be able to do most of the work of solving for primary and secondary stresses and deflections in trusses, for moments and shears in continuous frames, and for deflections, moments, and reactions in arches.

So far in our work we have concentrated on problems that occur frequently in the routine work of the bridge design office. At the present time a program is being prepared for the solution of vertical curves with varying superelevation. This program will enable the machine to produce in a matter of seconds a complete grid of grades at intervals as close as one foot if necessary. The saving that will result in the computation of bridge bearing elevations and field applications for vertical control should be significant.

An important advantage of the computer, in addition to speed, is the fact that it does not make an undetected error within the computer unit. This should be good news to any one familiar with the loss of time caused by hard-to-find errors in calculations concerned with complicated horizontal and vertical layout problems.

Small engineering organizations that cannot afford to rent a machine full time can go to a service bureau in many cities. These service bureaus, operated by major manufacturers and by private agencies, have many types of data-processing machinery which is available on an hourly rental basis.

Many large engineering organizations may find justification for the purchase or rental of a higher-speed computer. That is only half the system, however, because an organization must be provided to work with the machine. In the California Division of Highways all programming of problems and processing of data submitted for solution is centralized in the Tabulating Section of the Highway Planning Survey. This has proved to be a workable and efficient plan. General supervision of computer activities is under F. M. Reynolds, Principal Highway Engineer, with Sam Osofsky as Supervising Highway Statistician.

According to Mr. Osofsky one computer of the IBM 650 class, with allied equipment, can serve the needs of a highway department spending $300,000,000 for right-of-way and construction. This would assume 24-hour operation, and possibly the future installation of a tape input unit in place of the card input unit we now have.

As for the organization needed for programming and administration, it is difficult to give a definite answer. A large organization should expect to employ 3 to 6 programmers. An alternative would be to buy programming service from the manufacturer. Several engineers should be familiar enough with programming to be able to recognize applications and diagram them in detail as an aid to the programmer, who is usually not an engineer.

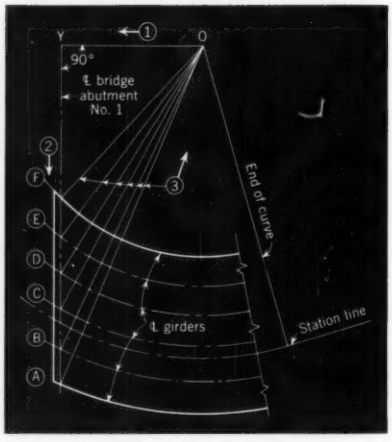


FIG. 3. Layout problem frequently encountered from curved alignment on bridges is solved by computer, eliminating need to look up angles and functions in tables, and to perform arithmetical operations on a desk calculator.

In brief, the organization would include the following: 1 section chief, 1 assistant, 3 to 6 programmers, and clerical personnel as needed (filing clerks, key punch operators, and such).

It is probably too early to make any definite statement as to time saved.

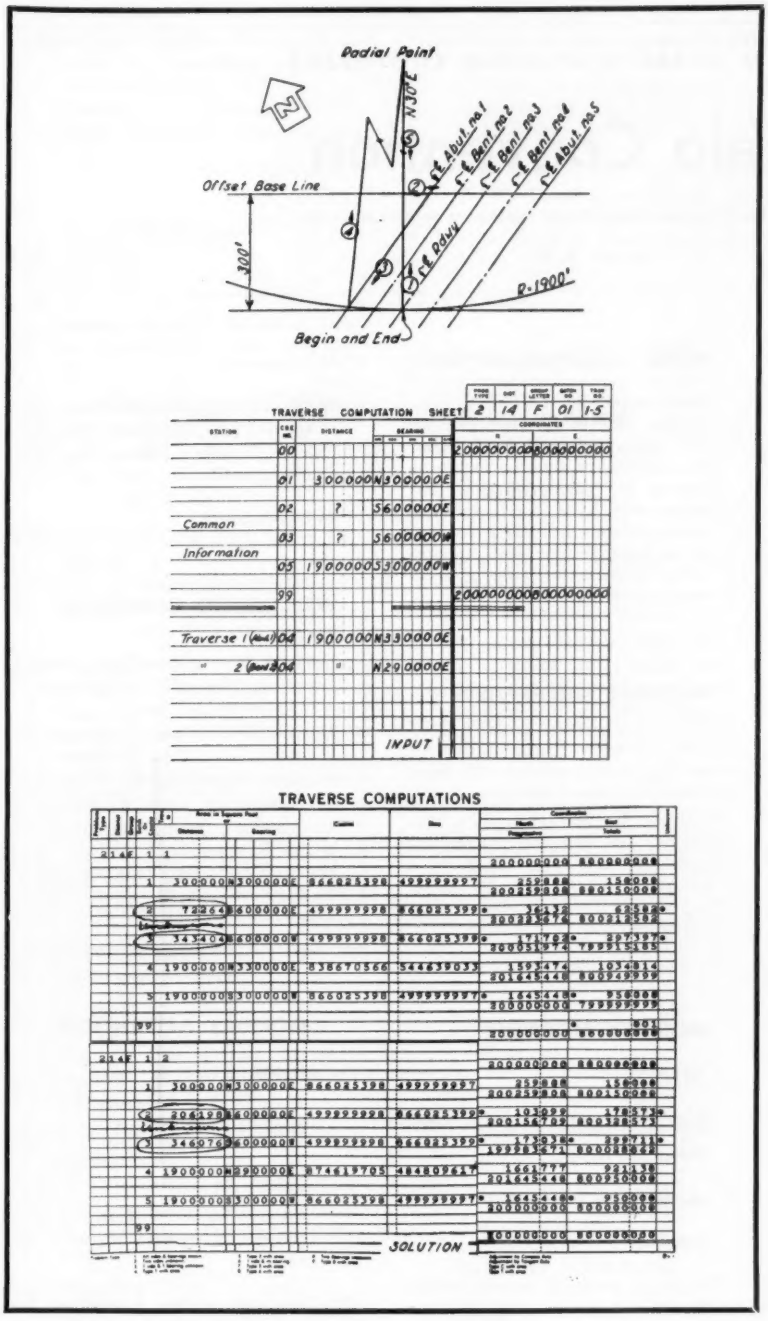
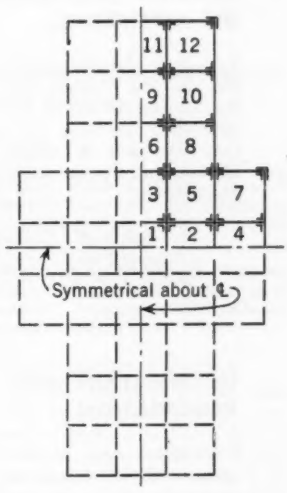


FIG. 4. Machine rapidly computes offsets from baseline to key points on curved bridge alignment. Problem and solution are set up on forms here shown. Answers given by machine are circled.

FIG. 5. Non-repetitive problems also can be solved economically by machine in many cases. Torsional stiffness of a suspension-bridge tower at a given section can be computed in 30 seconds. Twelve equations are needed for problem shown, but machine can handle as many as 42 unknowns.



Cell 1. $4T_1 - 2T_2 - 2T_3 = 84\,G\,\theta$
Cell 2. $4T_2 - T_1 - T_4 - 2T_5 = 84\,G\,\theta$
Cell 3. $4T_3 - T_1 - 2T_5 - T_6 = 84\,G\,\theta$
Cell 4. $4T_4 - T_2 - 2T_7 = 84\,G\,\theta$
Cell 5. $4T_5 - T_2 - T_3 - T_7 - T_8 = 84\,G\,\theta$
Cell 6. $4T_6 - T_3 - 2T_8 - T_9 = 84\,G\,\theta$
Cell 7. $4T_7 - T_4 - T_5 = 84\,G\,\theta$
Cell 8. $4T_8 - T_5 - T_6 - T_{10} = 84\,G\,\theta$
Cell 9. $4T_9 - T_6 - 2T_{10} - T_{11} = 84\,G\,\theta$
Cell 10. $4T_{10} - T_8 - T_9 - T_{12} = 84\,G\,\theta$
Cell 11. $4T_{11} - T_9 - 2T_{12} = 84\,G\,\theta$
Cell 12. $4T_{12} - T_{10} - T_{11} = 84\,G\,\theta$

Eventually we expect our electronic computer to do from 10 to 20 percent of the total work of the bridge design section.

It is too early to tell what the full impact of the application of computers to civil engineering problems will be. Already in the field of earthwork computations the high-speed machines have made traditional methods obsolete. In the structural field several developments are probable. Exact classical methods of analysis may enjoy renewed popularity because of the computer's ability to solve systems of equations and complicated mathematical expressions with ease. Acquisition of experience concerned with the effect of variables in difficult structural types, such as suspension bridges and arches on flexible piers, could be accelerated if the computer did the laborious work.

AMERICAN SOCIETY OF CIVIL ENGINEERS

Buffalo Convention

Buffalo Section Host, with participation of the Engineering Institute of Canada

Statler Hotel — Buffalo, N. Y. — June 3-7, 1957

REGISTRATION

Hotel Statler, Mezzanine Floor

Sunday, June 2: 1:00 p.m. to 7:00 p.m.

Monday through Wednesday: 8:30 a.m. to 5:30 p.m.

Thursday: 8:30 a.m. to 1:00 p.m.
Registration fee: $5.00 (except ladies and students).

ADVANCE INFORMATION ON ATTENDANCE

To help in planning adequate facilities for the Buffalo Convention, the Convention Committee would appreciate knowing in advance that you plan to attend. Please fill out the coupon on page 158 and mail to:

Mr. Ralph H. Gallinger
Engineer Park
Buffalo 7, N. Y.

INFORMATION AND REGISTRATION

Information and registration facilities will be maintained on the Mezzanine Floor of Hotel Statler from Sunday, June 2 through Thursday, June 6. Messages will be held for members at the Information Desk.

LADIES HOSPITALITY ROOM

The Grover Cleveland Room on the mezzanine floor of the Hotel Statler will be the place to meet other ladies attending the Buffalo Convention. The Hospitality Room will be open Monday through Friday from 9:00 a.m. to 5:00 p.m. Hostesses will be present at all times to be of service to guests. Coffee will be served from 9:00 a.m. to 11:30 a.m. each day.

HOTEL ACCOMMODATIONS

Headquarters for the Buffalo Convention will be the Hotel Statler. The Statler is located in the heart of downtown Buffalo on Delaware Avenue at Niagara Square. Arrangements have been made to accommodate convention visitors at the headquarters hotel. A reservation request for your convenience is provided on page 161.

AUTHORS' BREAKFASTS

8:00 a.m. — Hotel Statler
Monday, Tuesday, Wednesday, Thursday

Presiding: Louis S. Bernstein, Chairman, Technical Program Committee

Briefing session for speakers, discussers, and program officials for each day will take place at a breakfast meeting on the morning of that day. Attendance is by invitation.

MONDAY MORNING

JUNE 3

Soil Mechanics and Foundations Division

Committee on Earth Dams

9:00 a.m.

Presiding: Stanley D. Wilson, Member, Executive Committee, Soil Mechanics and Foundations Division

9:00 Utilization of Weathered Formation Materials for Trinity Dam Embankment
J. W. Hilf, M. ASCE, Supervisory Civil Engr., U. S. Bur. of Reclamation, Denver, Colo.

9:45 Discussion

10:00 The Use of Niobrara Chalk at Gavins Point Dam
H. A. Sikso, M. ASCE, Chief, Foundations and Materials Branch, Omaha Dist., Corps of Engineers, Omaha, Nebr.

10:45 Discussion

11:00 The Ambuklao Rock-fill Dam
E. M. Fucik, M. ASCE, Executive Vice President, Harza Eng. Co., Chicago, Ill.

11:45 Discussion

WELCOMING LUNCHEON

Monday, June 3

12:15 p.m. Main Ballroom, Hotel Statler

Presiding: Mason G. Lockwood, President, ASCE

Toastmaster: Nathan Schwartzman, Convention Chairman

Speaker: Clifford C. Furnas, Chancellor, Univ. of Buffalo.

All members, guests, and friends of ASCE are invited cordially to attend. Tickets for this event must be purchased not later than 11:00 a.m. on Monday.

MONDAY AFTERNOON

JUNE 3

Highway Division

2:30 p.m.

Presiding: Archie N. Carter, Member, Executive Committee, Highway Division

2:30 The role of the Consulting Engineer in the Accelerated Highway Program

3:00 Cooperation with Consultants by Highway Departments and Authorities
Conrad H. Lang, M. ASCE, Chief Engr., N. Y. State Thruway Authority, Albany, N. Y.

3:30 Contractors Organization for Large Highway Construction Contracts over $5,000,000
Howard E. Dixon, M. ASCE, Vice President, Johnson, Drake & Piper, Inc., New York, N. Y.

4:00 Material Quality Control Procedures for Consultants on Large Highway Projects

EDWARD A. ABDUN-NUR, M. ASCE, Consulting Engr., Denver, Colo.

Power Division

2:00 p.m.

Presiding: Robert A. Sutherland, Member, Executive Committee, Power Division

2:00 Design, Fabrication and Construction Experiences on Penstocks

GEORGE R. LATHAM, A.M. ASCE, Asst. Engr., Ebasco Services Inc., New York, N. Y.

3:00 Fabrication and Installation Operations

JOHN N. PIROK, M. ASCE, Engr., Design, Chicago Bridge & Iron Co., Chicago, Ill.

4:00 Suggested Criteria and Methods for Design of Penstocks

WILLIAM R. MARTIN, JR., J.M. ASCE; Engr.; and JAN A. VELTROP, J.M. ASCE, Civil Engr., both with Harza Engineering Co., Chicago, Ill.

Soil Mechanics and Foundations Division

Committee on Frost Action and Permafrost

2: p.m.

Presiding: Ralph B. Peck, Chairman, Executive Committee, Soil Mechanics and Foundations Division

2:00 Interim Report on Core Drilling in Permafrost

M. J. HVORSLEV, M. ASCE, Consultant, Waterways Experiment Sta., Corps of Engineers, Vicksburg, Miss.

2:30 Discussion

W. K. BOYD, M. ASCE, Chief, Frozen Ground Applied Research Branch, Snow, Ice and Permafrost Research Estab., Corps of Engineers, Wilmette, Ill.

2:45 Ventilated Building Foundations in Greenland

ROGER H. WILLIAMS, M. ASCE, Deputy Engr. in Charge, Metcalf and Eddy-Alfred Hopkins and Associates, Boston, Mass.

3:15 Discussion

W. E. FEIDT, Chief, Paving, Foundations and Materials Branch, Eastern Ocean Dist., Corps of Engineers, New York, N. Y.

3:30 Design and Construction of a Pile Foundation in Permafrost

J. C. IRETON, Foundations and Materials Branch, Alaska Dist., Corps of Engineers, Anchorage, Alaska.

4:00 Load Tests of Piles in Permafrost

W. C. DIAS, Arctic Constr. and Frost Effects Lab., New England Div., Corps of Engineers, Boston, Mass.

4:30 Discussion

POWER DIVISION FIELD TRIP

To Huntley Steam Station

Monday, June 3

Departs 7:00 p.m. from Hotel Statler, returns 9:30 p.m.

Construction Division, co-sponsor

Trip: To Huntley Steam Station, operated by Niagara Mohawk Power Corp. The present capacity of this installation is in excess of 750,000 kw, and currently under construction are 400,000 kw of additional capacity. The two new units will be rated at 200,000 kw and will have close-coupled compound turbines that will operate at 2400 psi and 1050 deg. F. It is expected that these generating units will produce one kwhr per 900 Btu. The new units are being placed in an area formerly occupied by four 30,000-kw stoker-fed units.

Transportation: By bus.

Cost: $1.00.

Tickets for this trip may be purchased at the Convention registration desk not later than 12:00 noon on Monday.

TUESDAY MORNING

JUNE 4

Highway Division

9:30 a.m.

Presiding: J. Paul Buckley, Secretary, Executive Committee, Highway Division

9:30 Special Highway Problems created by Construction of the Seaway and St. Lawrence Power Project

J. B. MCMORRAN, M. ASCE, Chief Engr., N. Y. Power Authority, New York, N. Y.

10:00 Ontario Highways

10:30 Metropolitan Traffic and Highway Problems

M. V. JONES, Metropolitan Planning Board, Toronto, Ont., Canada.

11:00 The Buffalo Thruway & Arterial Plan

E. G. H. YOUNGMANN, Dist. Engr., N. Y. State Dept. of Public Works, Buffalo, N. Y.

Power Division

9:30 a.m.

Presiding: Frank B. Cook, M. ASCE, Chief, General Eng. Branch, U. S. Bur. of Reclamation, Denver, Colo.

9:30 Determination of Stresses in Anchor Blocks

R. BOUCHAYER and S. FERRAND, Bouchayer & Viallet, Grenoble, France

10:30 Water Hammer Design Criteria

JOHN PARMAKIAN, M. ASCE, Technical Eng. Investigations, U. S. Bur. of Reclamation, Denver, Colo.

Soil Mechanics and Foundations Division

9:00 a.m.

Presiding: Ralph E. Fadum, Member, Executive Committee, Soil Mechanics and Foundations Div.

Symposium on Earthwork Features —St. Lawrence River Power and Seaway Projects, International Rapids Section

9:00 Soils and Earthwork Features

R. M. HAINES, A.M. ASCE, Soils Engr., St. Lawrence River Joint Board of Engrs., Massena, N. Y.; and G. E. OLSON, Chief, Foundations and Materials Branch, Buffalo Dist., Corps of Engineers, Buffalo, N. Y.

9:35 Discussion

9:45 Soil and Foundation Problems of the Long Sault Canal (co-sponsored by Structural Division)

HARRIS H. BURKE, M. ASCE, Bechtel Corp., Cougar, Wash.

10:15 Discussion

10:30 Earth Excavation Methods and Related Soil Problems

E. L. ARMSTRONG, M. ASCE, Asst. Project Manager, and RICHARD E. BURNETT, M. ASCE, Construction Manager, Reservoir Area, St. Lawrence River Power Project, Uhl, Hall and Rich, Massena, N. Y.

11:00 Discussion

11:15 Foundation Investigations and Designs for Dikes

J. N. HARRIS, Manager, Soils Div., St. Lawrence River Project; and J. R. MACARTHUR, Soils Engr., Uhl, Hall & Rich, Massena, N. Y.

Structural Division

9:30 a.m.

Presiding: James N. DeSerio, Member, Committee on Session Programs, Structural Division

9:30 Model Testing, Design and Construction of 350-ft Concrete Stack, Niagara Mohawk Power Corp.

NOTE: This unit is just started and will be under construction during the Convention. There will be a field trip by the Power Division on Monday evening to view the power station where this is being installed.

10:00 Welded Bridges in New York State

EDWARD J. RAMER, Principal Civil Engr., N. Y. State Dept. of Public Works, Albany, N. Y.

NOTE: There will be a Field Trip by the Highway Division on Wednesday morning covering part of the Thruway where many of these structures will be seen.

10:30 Survey of Susceptibility to Vibration of Various Types of Highway Bridges

L. T. OEHLER, J.M. ASCE, Physical Research Engr., Michigan State Highway Dept., East Lansing, Mich.

Waterways and Harbors and Hydraulics Divisions, Joint Session

9:30 a.m.

Presiding: Roger H. Gilman, Member, Executive Committee, Waterways and Harbors Division

Committee on Navigation and Flood Control Facilities, Waterways and Harbors Div.

9:30 St. Lawrence Seaway, 27-Ft Canals and Channels

WILLIAM GROTHAUS, St. Lawrence Seaway Development Corp., Massena, N. Y.; and D. M. RIPLEY, Hydraulic Engr., St. Lawrence Seaway Authority, Montreal, Que.

10:00 Long Sault Canal Locks

ROBERT B. MCKEE, A.M. ASCE, Civil Engr., Corps of Engineers, Buffalo, N. Y.

10:30 Beauharnois Canal Locks

D. MCINTYRE, Senior Hydraulic Engr., St. Lawrence Seaway Authority, Montreal, Que.

11:00 The St. Lawrence Seaway—Planning and Construction Progress

LAWRENCE H. BURPEE, A.M. ASCE, Deputy Chief Engr., St. Lawrence Seaway Authority, Montreal, Que.; and A. F. GRIFFIN, M. ASCE, Special Eng. Consultant, North Central Dist., Corps of Engineers, Chicago, Ill.

HIGHWAY DIVISION LUNCHEON

Tuesday, June 4

12:15 p.m.
New York Room, Hotel Statler

Presiding: EDWARD J. NUNAN, M. ASCE, President, Buffalo Section, ASCE; Sales Manager, Buffalo Salg Co., Inc., Buffalo, N. Y.

Speaker: BERTRAM D. TALLAMY, Federal Highway Administrator, Washington, D. C.

All members, guests and friends of ASCE are invited cordially to attend. Tickets may be purchased at the Convention registration desk not later than 5:30 p.m., on Monday.

HIGHWAY DIVISION FIELD TRIP

New York State Thruway

Tuesday, June 4

Departs 2:00 p.m. from Hotel Statler, returns 5:00 p.m.

Trip: Visit to construction sites and completed portions of New York State Thruway. Presently open to traffic is the 900-mile expressway from New York City to Buffalo. Now under construction is the 80-mile road from Buffalo to the western border of New York State near Erie, Pa. The Thruway is a toll road constructed and operated by the New York State Thruway Authority. The road is free from all intersections and has special interest features to relieve driver fatigue from repetitious scenery. The most modern design features were employed to afford safe and convenient highway travel.

Transportation: By bus.

Tickets may be purchased not later than 5:30 p.m., Monday, June 3 at Convention registration desk.

POWER DIVISION FIELD TRIP, LUNCHEON MEETING

Sir Adam Beck Hydroelectric Station

Tuesday, June 4

Departs 12:00 noon from Hotel Statler, returns 6:00 p.m.

Trip: Visit to Sir Adam Beck Hydroelectric Station, operated by the Hydroelectric Power Commission of Ontario, Canada, and located on the Niagara River about five miles downriver from Niagara Falls. Construction was made in two stages according to existing U. S. & Canadian treaty provisions concerning water diversions. The first was completed in 1930 and the second in 1956. An interesting feature of the installation is a pumped storage development by means of which water is pumped into storage at night and released subsequently for daytime peaking. Total installed capacity aggregates 1,953,000 hp. Also on the tour is a visit to the Niagara Remedial Works above the Falls. The international venture was designed to provide a more even distribution of flow over the Falls and to maintain desired water levels in the upper reaches of the river.

Transportation: By bus.

Luncheon: Provided for on tour.

Tickets may be purchased not later than 5:30 p.m., June 3 at Convention registration desk.

STRUCTURAL DIV. FIELD TRIP, DINNER MEETING

Bethlehem Steel Plant

Tuesday, June 4

Departs 2:00 p.m., Hotel Statler, returns in evening

Trip: To Bethlehem's Buffalo Steel Plant, sixth largest in the world in terms of steel production. Strip mill and bar mill are among points of interest on tour. A 100-million-dollar expansion program is almost completed at the Lake Erie Shore plant, which employs nearly 20,000 people.

Transportation: By bus.

Dinner: Provided for on tour.

Cost: $3.00 per person.

Tickets may be purchased not later than 5:30 p.m., June 3, at Convention registration desk.

WEDNESDAY MORNING

JUNE 5

Conditions of Practice Department

9:00 a.m.

Presiding: Glenn W. Holcomb, Vice President, ASCE; Chairman, Dept. of Conditions of Practice

Committee on Registration

9:00 Address of the President
MASON G. LOCKWOOD, President, ASCE.

9:30 Registration a Must for Professional Recognition
NEWELL L. FREEMAN, Secretary, Board of Examiners for Professional Engrs. and Land Surveyors, State of New York.

10:15 Subject to be Announced
J. M. MUIR, P. Eng., Secretary-Treasurer, Dominion Council of Professional Engrs. (Canada).

Power Division

9:30 a.m.

Presiding: Glenn H. Von Gunten, Chairman, Power Division Committee on Progress in Power Plant Design

9:30 Design, Fabrication and Installation of High-Pressure Wyes and Multi-Layer Penstocks
E. SCHMITZ, A. O. Smith Corp.

10:30 Penstock Experience & Design Practice of P.G. & E. Co.
GORDON V. RICHARDS, A.M. ASCE, Senior Civil Engr., Pacific Gas and Electric Co., San Francisco, Calif.

Structural Division

9:30 a.m.

Presiding: James N. DeSerio, Member, Committee on Session Programs, Structural Division

9:30 Design of Folded Plate Roofs
HOWARD SIMPSON, A.M. ASCE, Assoc. Prof. of Structural Eng., Mass. Inst. of Technology, Cambridge, Mass.

10:00 Test of Reinforcing Concrete Folded Plate Structure
ROBERT B. MOORMAN, M. ASCE, Chairman and Prof. of Civil Eng., Syracuse Univ., Syracuse, N. Y.

10:30 Application of Prestressing to Folded Plate Structures
ALFRED L. PARME, A.M. ASCE, and W. BURR BENNETT, Structural and Railways Bur., Portland Cement Assoc., Chicago, Ill.

Waterways and Harbors and Hydraulics Divisions, Joint Session

9:30 a.m.

Presiding: Roger H. Gilman, Member, Executive Committee, Waterways, and Harbors Division

Committee on Navigation and Flood Control Facilities

9:30 Great Lakes Harbors
E. W. NELSON, Chief, Eng. Div., North Central Div., Corps of Engineers, Chicago, Ill.

10:00 The Niagara Falls Control Structure
OTTO HOLDEN, M. ASCE, Chief Engr.; and JOHN L. SOARE, Project Engr., The Hydro-Electric Power Commission of Ontario, Toronto, Ont.

10:30 The Welland Canal
W. A. O'NEILL, Div. Engr., St. Lawrence Authority, St. Catharines, Ontario.

11:00 Restoration of Presque Isle (Sponsored by Committee on Coastal Eng.
LOREN W. OLMSTEAD, M. ASCE; Col., Corps of Engineers, U. S. Army, Buffalo, N. Y.; and GERALD A. LYNDE, Civil Engr., Buffalo Dist., Corps of Engineers, Buffalo, N. Y.

WEDNESDAY AFTERNOON

JUNE 5

Conditions of Practice Department

2:30 p.m.

Presiding: Norman R. Moore, Vice President, ASCE, and Vice Chairman, Committee on Conditions of Practice

Public Hearing of Committee on Junior Members

Moderator: Trent R. Dames, Chairman, Committee on Junior Members

(A) Indoctrination and Orientation
FRANK W. EDWARDS, Vice Chairman, Committee on Junior Members.

(B) Participation in Society Affairs
NOMER GRAY, Committee on Junior Members.

CONDITIONS OF PRACTICE LUNCHEON

Wednesday, June 5

12:15 p.m.
Rendezvous Room, Hotel Statler

Presiding: GLENN W. HOLCOMB, Vice President, ASCE, and Chairman, Committee on Conditions of Practice.

Speaker: WILLIAM H. WISELY, Executive Secretary, American Society of Civil Engineers.

Subject: The Young Engineer in ASCE: an Objective Analysis of the Facts.

Tickets may be purchased not later than 5:30 p.m., Tuesday, June 4 at Convention registration desk.

(C) Loss of Transfer to Assoc. Member
TRENT R. DAMES, Chairman, Committee on Junior Members.

(D) Revision of Member Grades
WILLIAM S. LALONDE, M. ASCE, Chairman, Civil Eng. Dept., Newark College of Engineers, Newark, N. J.

(E) Written Communications
JAMES MORGAN, JR., Committee on Junior Members.

Power Division

2:00 p.m.

Presiding: A. W. F. McQueen, M. ASCE, General Manager, H. G. Acres & Co., Niagara Falls, Ont., Canada

2:00 Some Aspects of Kemano Pressure Conduit Engineering Investigations

3:00 Design, fabrication and construction of large pressure conduits

4:00 Raquette River Development—Design and Construction
LOUIS S. BERNSTEIN, M. ASCE, Chief Design Engr., Niagara Mohawk Power Co., Buffalo, N. Y.

Sanitary Engineering Division

2:30 p.m.

Presiding: Richard Hazen, Chairman, Executive Committee, Sanitary Engineering Division

2:30 Water Quality Investigation in the Lower Detroit River
FRANCIS P. COUGHLIN, JR., J.M.

ASCE, Engineer, Hazen & Sawyer, New York, N. Y.

3:00 Pollution of Niagara River and Tributary Waters

REYMOND HESS, Chief Chemical Engr., National Aniline Co.

3:30 (New topic)

A. E. BERRY

4:00 Lake Erie Pollution Survey in Ohio

FREDERICK H. WARING, M. ASCE, Chief Engr., State Dept. of Health, Columbus, Ohio.

Waterways and Harbors and Hydraulics Divisions, Joint Session

2:30 p.m.

Committee on Research, Waterways and Harbors Division

Presiding Roger H. Gilman, Member, Executive Committee, Waterways and Harbors Division

2:30 Laboratory Investigation of Rubble-mound Breakwaters

R. Y. HUDSON, M. ASCE, Chief, Wave Action Section, Waterways Experiment Sta., Corps of Engineers, Vicksburg, Miss.

3:00 Great Lakes Connecting Channels Project

PETER C. HYZER, Col., Corps of Engineers, District Engr., and H. E. HILL, Chief, Eng. Div., Detroit Dist., Corps of Engineers, Detroit, Mich.

3:30 Diversion of Waters from the Great Lakes

HARLEY F. LAWHEAD, M. ASCE, North Central Div., Corps of Engineers, Chicago, Ill.

4:00 Niagara Falls Model Studies

A. P. ROLLINS, Col., Corps of Engineers, Director; and GEORGE B. FENWICK, M. ASCE, Chief, Rivers and Harbors Branch; Waterways Experiment Sta., Vicksburg, Miss.

Structural Division

2:30 p.m.

Presiding: James N. DeSerio, Member, Committee on Session Programs, Structural Division

2:30 Prestressed Wind Bracing in Queen Elizabeth Hotel

D. A. CHAMBERLAIN, JR.

3:00 The Design of the Deas Island Tunnel

T. BROENDUM-NIELSEN and PER HALL, A.M. ASCE, Asst. Chief Engr., Foundation Co. of Canada, Ltd., Montreal, Quebec, Canada.

3:30 The Lessons to be Learned from Concrete Failures

H. JOHN RACEY.

ENGINEERS' PARTY

Cocktail Party, Dinner and Dance

Main Ballroom, Hotel Statler

Wed., June 5, 6:30

The Engineers' Party will be the main social event of the Convention. Cocktails will be served at 6:30 followed by dinner at 7:30 in the main ballroom at the Hotel Statler. Dancing will begin at 10:00 in the main ballroom. Dress will be informal. All members, wives and guests are invited to attend.

Presiding: MASON G. LOCKWOOD, President, ASCE.

Dinner Toastmaster: EDWARD J. NUNAN, President, Buffalo Sect., ASCE.

Speaker: WILBER M. BRUCKER, Secretary of the Army.

Tickets may be purchased until 5:30 p.m., Tuesday, June 3, at the Convention registration desk.

THURSDAY MORNING

JUNE 6

Construction Division

9:30 a.m.

Presiding Warren N. Riker, Vice Chairman, Executive Committee; and John T. Senesy, Chairman, Committee on Session Programs, Construction Div.

9:30 Construction of Cofferdams in Swift-Flowing Streams

EDWIN P. SWATEK, JR., M. ASCE, Chief Design Engr., Dravo Corporation, Pittsburgh, Pa.

10:15 How a Difficult Physical Condition Was Met by Proper Plant Selection

JOSEPH FREIN, Chief Engr., Morrison Knudsen, Boise, Idaho.

Hydraulics and Waterways and Harbors Divisions, Joint Session

9:30 a.m.

Presiding: Arthur T. Ippen, Member, Executive Committee, Hydraulics Division

Committee on Research, Hydraulics Division

9:30 Research Projects for St. Lawrence Seaway Conducted at National Research Council

W. D. BAINES, J.M. ASCE, Head, Hydraulic Lab., National Research Council (Canada), Montreal Road, Ottawa, Ont., Canada.

10:00 American Models of St. Lawrence Seaway, Cornwall Island Vicinity

E. B. LIPSCOMB, M. ASCE, Engr. Supervising Hydraulic Research, Waterways Experiment Sta., Vicksburg, Miss.

10:30 Introductory Remarks on Hydraulic Models of St. Lawrence Power Project

OTTO HOLDEN, M. ASCE, Chief Engr., Hydroelectric Power Commission of Ontario, Toronto, Canada.

11:00 Hydraulic Models of St. Lawrence Power Project

J. B. BRYCE, Hydraulic Engr., Hydroelectric Power Commission of Ontario, Toronto, Canada.

Sanitary Engineering Division

9:30 a.m.

Presiding: Richard Hazen, Chairman, Executive Committee Sanitary Engineering Division

9:30 Intake Designs in Detroit River

EUGENE A. HARDIN, M. ASCE, Civil and Sanitary Engr., Parsons, Brinckerhoff, Hall and Macdonald, New York, N. Y.

10:00 Intake Designs in Niagara River and Lake Ontario

RAYMOND H. N. MURRAY.

10:30 Intake Designs in Lake Erie

CARL W. REH, A.M. ASCE, Engr., Greeley and Hansen, Engineers, Chicago, Ill.

11:00 Present Picture "Deep Inch" showing pipe line across Straights of Mackinac

A. M. EICHER and JOSEPH TROXELL.

Structural Division

9:30 a.m.

Presiding: James N. DeSerio, Chairman, Committee on Session Programs, Structural Division

9:30 The St. Lawrence Power Project—Overall Planning and Basic Design

GEORGE R. RICH, M. ASCE, Uhl, Hall & Rich, Boston, Mass.

10:00 Electrical Engineering Features of the St. Lawrence Power Project

J. S. SALOMA, Uhl, Hall & Rich, Boston, Mass.

10:30 Structural Features of Long Sault Canal Locks, St. Lawrence Seaway

STANLEY B. HUNT, Chief of Eng. Div., Corps of Engineers, Buffalo, N. Y.

ST. LAWRENCE SEAWAY AND POWER PROJECT LUNCHEON

With Multi-Division Co-sponsorship

Thursday, June 6

12:15 p.m. New York Room

All members, guests and friends of ASCE are invited cordially to attend. Tickets may be purchased for this event before 5:30 p.m. on Wednesday, June 5.

THURSDAY AFTERNOON JUNE 6

Hydraulics Division

2:30 p.m.

Presiding: Arthur T. Ippen, Member, Executive Committee, Hydraulics Division

Committee on Design

2:30 Regulation of Lake Ontario by International St. Lawrence River Power Project

R. H. CLARK, Water Resources Branch, Dept. of Northern Affairs and National Resources, Ottawa, Ont., Canada.

FRANKLIN F. SNYDER, M. ASCE, Hydraulic Engr., Dept. of the Army, U. S., Washington, D. C.

3:00 Grass River and Eisenhower Lock Models

MARTIN E. NELSON, M. ASCE, Chief, Hydraulics Lab. Branch, and HARVEY J. JOHNSON, A.M. ASCE, Hydraulic Engr., St. Paul Dist., Corps of Engineers, St. Paul, Minn.

3:30 Hydraulic Design Problems of St. Lawrence Project Power Facilities

GEORGE E. HYDE, M. ASCE, Hydraulic Engr., Uhl, Hall, and Rich, Engrs., Massena, N. Y.

Construction Division

2:30 p.m.

Presiding: Warren N. Ricker, Vice Chairman, Executive Committee; and John J. Senesy, Chairman, Committee on Session Programs, Construction Division

2:30 Skylines

W. F. KENNEDY, Engr., Bethlehem Steel Co., New York, N. Y.

3:15 Mackinaw Straits Bridge

J. PERANO, Chief Engr., Merritt, Chapman & Scott, New York, N. Y.

Sanitary Engineering Division

2:30 p.m.

Presiding: Richard Hazen, Chairman, Executive Committee, Sanitary Engineering Division

2:30 Industrial Waste Treatment and Metropolitan Needs for Sewers and Sewage Treatment for Niagara Falls

EDWARD J. SMITH, Supt. of Sewage Treatment, Niagara Falls, N. Y.

3:00 Sewage Problems at Buffalo, N. Y., and Revenue Sources

FREDERICK W. CRANE, M. ASCE, General Manager, Buffalo Sewer Authority, Buffalo, N. Y.

3:30 Metropolitan Sewers and Sewage Treatment for Rochester, N. Y.

DOW HAMBLIN, Commissioner of Public Works, Rochester, N. Y.

WOMEN'S PROGRAM

Sunday, June 2, 1:00 p.m. to 7:00 p.m.: Registration on Mezzanine Floor, Hotel Statler

Monday, June 3: "Get Acquainted" Tea at Hotel Statler

Tuesday, June 4: Tour of Niagara Falls and Old Fort Niagara and Luncheon at Niagara Falls Country Club.

Wednesday, June 5: Time provided for shopping, visiting museums, etc. Suggestions at Women's Headquarters. Dinner Dance in evening.

Thursday, June 6: Luncheon at Twentieth Century Club. Entrain for Massena and the St Lawrence Seaway in the evening.

GENERAL CONVENTION EXCURSION

Thurs. Evening to Sat. Morning

June 6, 9:00 p.m., to June 8, 9:00 a.m.

All Aboard for the St. Lawrence

The special tour to the St. Lawrence Seaway and Power Project is one of the many attractive features of the Buffalo Convention. The tour will include round-trip train transportation via private train with sleeping accommodations, meals en route and while at the project, and the special inspection trip at the seaway and power development. The special train will leave Fort Erie, Ontario, at 9:30 p.m., Thursday evening, June 6, and will return to Fort Erie at approximately 9:00 a.m., Saturday morning. Buses will provide transportation between the Hotel Statler and Fort Erie.

Many of the important phases of design and construction will be presented by means of papers and discussions at the Convention prior to the tour. Thus, well briefed, the ASCE delegates will gain further enjoyment and value from the specially conducted tour to the construction site. The tour will coincide with major construction activity on the job. Points of interest included in the tour are the Grass River and Dwight D. Eisenhower Locks, the Long Saul Dam, Barnhart Island Powerhouse, and the Iroquois Regulating Dam. The locks of the Seaway are capable of lifting vessels 85 ft through the 10-mile-Long Sault Canal which bypasses the adjacent power project structures.

Here indeed is a unique opportunity for all civil engineers to see, under ideal conditions, one of the century's most fascinating construction undertakings. Every effort has been made to make the

tour as valuable, convenient, and economical as possible for the delegates and their families who take advantage of this opportunity.

Buffalo departure: Thursday, 9:00 p.m., June 6, by bus from Hotel Statler; 9:30 p.m., by train from Fort Erie, Ontario, Canada

Massena arrival: Friday, 8:00 a.m., June 7.

Massena departure: Friday 9:00 p.m., June 7.

Return to Buffalo: Saturday 9:00 a.m., June 8.

Estimated cost: Approximately $35 per person. Includes transportation, roomette, sleeping accommodations and meals. Some compartments and bedrooms will be available.

Reservations for this tour must be made early

BUFFALO CONVENTION COMMITTEES

General Chairman
Nathan Schwartzman

Steering Committee
Louis S. Bernstein, Frederick W. Crane, Edward J. Nunan, Newell L. Nussbaumer, Loren W. Olmstead, Nathan Schwartzman

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ENGINEERS'

Piers supported by passive earth pressure

NOBLE G. ROBBINS, Structural Engineer, Pure Oil Company, Chicago, Ill.

A short-cut method has been developed by the writer to save time in the oft-repeated operation of designing a concrete pier to resist a horizontal force, taking into account the passive earth pressure.

The graph, Fig. 1, was prepared from the following equation:

$$P_P - P_A = \frac{4W_P\,(2 + 3\,F)}{X^2}$$

in which,

P_P = total passive earth pressure
P_A = total active earth pressure
W_P = total horizontal load applied
$F = \frac{H}{X}$, as shown in Fig. 2
X = distance pier extends below grade, values on curved lines in Fig. 1

To find P_P, use the formula:

$P_P = W_e \tan^2 (45 + \frac{1}{2}\,\phi) = 350$ lb

where W_e = weight of earth = 100 lb per cu ft

ϕ = angle of repose of earth = 33° 41′

Example solved

The following problem illustrates the method of using the nomograph. A horizontal load of 300 lb is applied to a single post stanchion at a point 15 ft above grade. Determine the depth and width of a concrete pier required to resist this force. The pier is to be earth formed, using the passive earth pressure as a resisting force.

Enter the graph, Fig. 1, at H = 15 ft, and move to the right along the dashed line. The surves represent depth of excavation. The dashed line intersects the 6-ft curve at the 300-lb point (see horizontal scale). This means that a pier 12 in. wide and 6 ft deep will resist a 300-lb horizontal force applied to it 15 ft above grade.

Since the 5-ft curve is intersected at 180 lb, if the pier extended below grade only 5 ft, it would have to be 20 in. wide. The equation would be:

$$\frac{300}{180} \times 12 \text{ in.} = 20 \text{ in.}$$

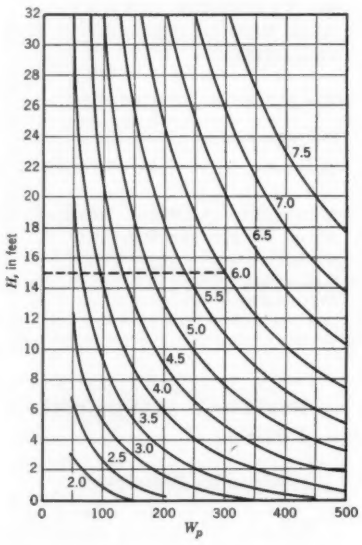


FIG. 1. Nomograph gives depth of pier required below grade (*X*, curved lines) when applied load (W_P, horizontal scale) is pounds per sq ft of projected width of pier normal to applied load, is known, and when height above grade of application of applied load (*H*, vertical scale) is also known.

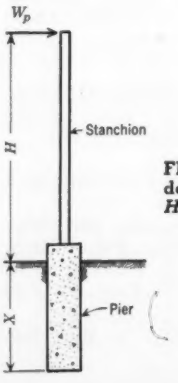


FIG. 2. Diagram defines terms W_P, *H*, and *X*.

NOTEBOOK

Earthwork quantities for pipe trenches by nomograph

RICHARD A. MILLER Branford Associates, Civil Engineers, Branford, Conn.

To determine the quantity of excavation in a pipe trench with vertical sides, the nomograph, Fig. 1, has been prepared. It is based on the assumption that the excavation is 2 ft wider than the pipe diameter. The equation on which the nomograph is based is:

$$Q = \frac{(D + 2) \times H \times L}{27}$$

in which,

Q = quantity of excavation, cu yd
D = diameter of pipe, ft
H = depth of excavation, ft
L = length of excavation, ft
A = area of cross section, sq ft

Then $27\ Q = (D + 2) \times H \times L$

$\log 27 + \log Q = \log (D + 2) + \log H + \log L$

$\log A = \log (D + 2) + \log H$

$\log 27 + \log Q = \log A + \log L$

The derivation of the variables from which the nomograph was designed is given in Table I.

On the nomograph, the scale for pipe diameter, shown in inches for convenient reading, is at the extreme left, and the scale for average depth of excavation is second from the right. Lying directly between these two is a pivot line which could actually be scaled and labeled as cubic yards of excavation per foot of length. At the extreme right is the scale for length of excavation. The final scale, which shows the quantity of excavation, lies between these last two scales.

In the example illustrated, the pipe diameter is assumed to be 24 in. and the average depth of excavation is assumed to be 4 ft. A straight line drawn between these two will mark a point on the pivot line. A straight line from this point on the pivot line to the assumed length of 100 ft shows that the quantity of excavation is 59 cu yd.

FIG. 1. Nomograph gives quantity of excavation for drainage pipe when pipe diameter, depth of excavation, and length are known.

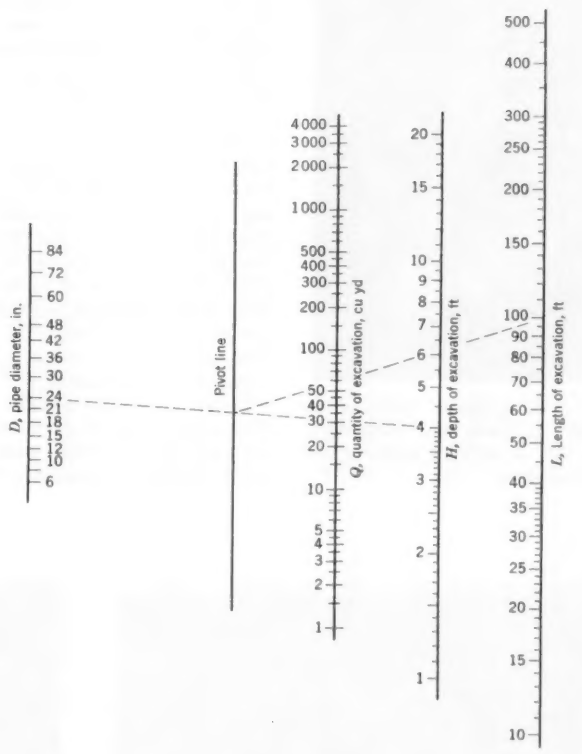


TABLE I. Derivation of variables for nomograph

Variable	Limits of Variable	Functions of Variable	Range of Function	Modulus	Equation of Scale
D	0.5 to 7	$\log (D + 2)$	1.00	6	$u = 6 \log (D + 2)$
H	1 to 20	$\log H$	1.00	6	$v = 6 \log H$
A	.....	$\log A$	....	$\frac{6 \times 6}{6 + 6} = 3$	$x = 3 \log A$
L	10 to 500	$\log L$	1.00	6	$y = 6 \log L$
Q	.....	$\log 27\ Q$	....	$\frac{3 \times 6}{3 + 6} = 2$	$z = 2 \log 27\ Q$

SOCIETY NEWS

Old Man River — Jackson Convention Theme

Old Man River dominated the Society's Spring Convention—the technical program, the inspection trips to the Waterways Experiment Station, and the atmosphere of Jackson, capital city of Mississippi and host to the Convention, February 18-21. It was the first national convention of the Society ever held in Mississippi, and the whole state joined the Mid-South Section in giving the red carpet treatment to the engineer visitors.

The Hon. J. P. Coleman, governor of Mississippi, addresses the Governor's Luncheon, one of the high points of the Jackson Convention.

From the governor of the state, the Hon. J. P. Coleman, and the mayor of the city, the Hon. Allen C. Thompson; from the Chamber of Commerce; from members in Mississippi and their ladies; from other citizens; and from the press, the reception was as heartwarming as it was overwhelming.

In greeting the group Governor Coleman declared, "We're glad to welcome you to Mississippi. We want you to stay. If you must go at the close of your Convention, come again soon, for keeps." To emphasize Jackson's greeting and to honor the profession, Mayor Thompson proclaimed the period of the Convention, "Civil Engineers Week in Jackson." A measure of the member interest in this first ASCE Convention in the state was the large (for a spring Convention) attendance of 1,550 members, guests, and students.

In his appreciative response to Mayor Thompson's address at the Wednesday morning general session, President Mason Lockwood explained the purposes of our Society in the following well chosen words:

"Today's largest profession stands squarely between the hopes, the aspirations, the sublimest yearnings of mankind and most of the awesome uncertainties which presently obscure and threaten to block the march of civilization. The substance of our Society is the composite skill and judgment of nearly forty thousand serious-minded engineers freely exchanging ideas for the technical advancement and professional development of the civil engineering profession.

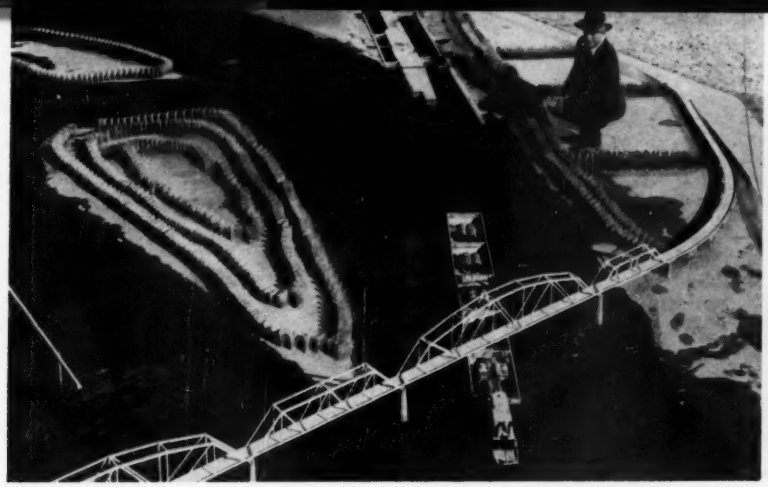
"These conventions are merely the instrumentality for the coordinated release of the hundreds of technical and professional papers . . . the end product of countless numbers of individuals and committees working interminable hours to make available for the general good the latest and best . . . in an ever-changing pattern of technological improvement."

Mississippi River Floods Controlled

Throughout the week-long series of technical and professional sessions, exhibits, and inspection trips ran the theme of the Convention—the Mississippi River and the situations, good and bad, created by it.

Left-hand view shows President and Mrs. Mason Lockwood, ASCE Vice-President Norman Moore, and Executive Secretary W. H. Wisely at the Joint Structural and Soil Mechanics Luncheon. Guiding one of the daily Authors' Breakfasts are

(left to right in right-hand photo) Raymond W. Sauer, president of Mid-South Section; Earl C. Meserve, secretary; and Willard J. Turnbull, chairman of Technical Program Committee.



Members of University of Kentucky Student Chapter watch radio-controlled tow maneuvering into model of Ohio River Lock 41, near Louisville. This was one of many exhibits engrossing visitors to Waterways Experiment Station.

Vicksburg, an hour's ride to the west of Jackson, is the headquarters of the Mississippi River Commission, of the Waterways Experiment Station, and of the Lower Mississippi Valley Division of the Corps of Engineers. At Clinton, near Jackson, there is a 200-acre-scale working model of the Mississippi River system, said to be the world's largest. It is operated by the Corps of Engineers to predict and verify flood heights for both known and expected storms anywhere on the watershed. Under construction since 1943, this partially completed gigantic model is in constant use. During the inspection trip ASCE members watched a shortened version of the 1952 flood as it was being run. Electrically operated controls inject the water into the model at proper points and at the known flood rates. Remotely operated gages automatically record the river stages at downstream points on instruments in a central control office.

At both Clinton and Vicksburg, the ASCE visitors were welcomed by Col. Andrew P. Rollins, Jr., M. ASCE, director of the Station, who explained that the mission of the station is to "assist the Corps of Engineers and other agencies of the Department of Defense to develop the best hydraulic, soils, concrete, and flexible pavement designs possible for the lowest possible cost."

In introducing the problem of controlling Mississippi River floods in the lower valley, Maj. Gen. John R. Hardin, M. ASCE, president of the Mississippi River Commission, told the Convention, "It is probable that no engineering undertaking has ever been the subject of so much study and examination by so many qualified persons. Literally Millions of words have been written on the subject, with an extremely wide diversity of opinion. The present plan of improvement may truthfully be said to have evolved through a gradual process of development, using the best features proposed, after the most thorough study possible."

The Jadwin Plan, adopted in 1928 and since modified, includes and combines reservoirs, cutoffs to shorten the river, levees and revetments, and floodways on the lower river to provide secondary

Mayor Allen C. Thompson and Mrs. Thompson were hosts to the ASCE Wives on a tour of fast-growing Jackson. With Mayor Thompson (in usual order) are members of the Ladies Committee: Mrs. Arthur C. Miller, vice-chairman; Mrs. Horace Lester, hostess; and Mrs. Sydney W. Chandler, chairman.

Col. A. P. Rollins, Jr., director of Waterways Station, is pictured in view at left, dining with A. P. Rollins, Sr., general manager of North Texas Municipal Water District, and Eugene P. Fortson, Jr., vice-chairman of Technical Program

Committee. In photo at right are student paper prize winners: B. J. Sellers, Mississippi State College; J. L. Paris, University of Mississippi; and W. J. Shireman, University of Arkansas.

President Mason Lockwood greets Maj. Gen. John R. Hardin, president of Mississippi River Commission. At left is Capt. Lewis C. Coxe, CEC, USN, chairman of Executive Committee of Waterways and Harbors Division. At right is ASCE Vice-President Norman Moore, and at his right Sydney W. Chandler, general Convention chairman.

Mrs. Boyce H. Biggers (center) welcomes Mrs. Mason Lockwood (left) to Jackson. Between them is Mrs. Norman Moore, and at right Mrs. Sydney Chandler. At Mrs. Chandler's right is Mrs. Ben T. Collier. Mrs. Chandler was chairman of the Ladies Committee.

outlets for flood waters. Although the maximum discharge ever measured on the river proper was 2,159,000 cfs in 1937 at Arkansas City, the hypothetical flood which might be produced from a sequence of probable storms is taken at 3,000,000 cfs at the latitude of Old River, below Natchez. It is this flood for which the control system is being built. In explaining how a flood of this magnitude will be handled, General Hardin said that, below Old River half a flood of this size will be diverted west through the Morganza and West Atchafalaya floodways to the Atchafalaya River. Of the 1,500,000 cfs left to flow down the main river channel, 250,000 cfs will be diverted east through Bonnet Carré Spillway into Lake Pontchartrain and on to the Gulf. The remaining 1,250,000 cfs will continue down the river, pass New Orleans with safety, and discharge to the Gulf. Already the main river channel has been shortened 140 miles by cutoffs. Cutoffs have provided better hydraulic grades, more flood-carrying capacity at equal or lower stages, and greatly improved navigation conditions.

Describing the more detailed problems of constructing, operating, and maintaining the huge flood control system described by General Hardin was a galaxy of important papers sponsored by the Waterways and Harbors Division, the Hydraulics Division, the Irrigation and Drainage Division, and the Soil Mechanics and Foundation Division. These papers covered the operation of Missouri River reservoirs, the operation of the river below Baton Rouge, the control of the Gulf outlet of the river, reclamation of Mississippi delta lands by drainage, the use of digital computers for the solution of problems related to river hydraulics, equipment for telemetering hydrologic data, the design and construction of specific river structures, the silting of reservoirs, and studies related to flow of water in alluvial streams. Most of these papers will be published in Division Journals, and will be available, also, as separates. Watch for their listing in coming issues of CIVIL ENGINEERING.

New Developments in Photogrammetry

In an exciting presentation before the Surveying and Mapping Division, Prof. Charles L. Miller, J. M. ASCE, director of the Photogrammetry Laboratory at M.I.T., pointed out that while better lenses, better cameras, and better plotting instruments are being produced for the purpose of using photographs for making physical measurements more accurately there yet remain in the photogrammetric method several important manual steps that can be shortened in time requirements. They are (1) ground control surveys, (2) compiling and plotting the map from stereo pairs, and (3) the inking of the final map. Current research and development can be expected to produce first-order plotters and electronic surveying systems which will greatly reduce the manual phase of making ground-control surveys. The human stereoplotter operator's work is mechanical in nature, but human judgment does play an important role in it. Professor Miller stated that research has been underway for some time on a completely automatic stereoplotting system in which the human element is replaced by electronic systems. In fact the investigations have reached the prototype stage. The final drafting phase, "an ink tracing on linen," Professor Miller stated, can cost as much as 30 percent of the whole cost of a photogrammetric mapping project. There is room for time-saving here, too. The U. S. Geological Survey and other mapping organizations have been studying plastic scribing to speed up manual requirements in drafting.

Several groups are working toward the next goal of combining photogrammetry with electronic computers for the reduction of data. Among these are the Ohio Department of Highways and the Long Island firm of Lockwood, Kessler and Bartlett, Inc.

Highway departments will spend $200,000,000 or more in the next ten

years for photogrammetry which, Professor Miller feels, justifies spending as much as a million dollars a year for the next ten years to explore the tremendous possibilities of its use and to develop equipment and techniques.

Bridges, Roads, Pipelines, and Power

During one of the four well-attended sessions of the Structural Division Stewart Mitchell, M. ASCE, consulting engineer of Sacramento, in a paper on "Vehicle Loads and Highway Bridge Design," asked the question, "Why should we consider changing our present bridge design practice?" He answered his own question by pointing out that no highway bridge of modern design based on H-15 or heavier loadings has failed or showed signs of failure which can be attributed to the effect of the loads passing over it. Supporting his conclusion by data, he stated that "bridges designed by the current specifications using the H20-S16 loading are of as high a standard of load-carrying capacity as economy will justify."

In the interest of safety alone, control of access to intra-continental expressways is a vital necessity, Charles M. Noble, M. ASCE, recently appointed director of the Ohio State Department of Highways, stated in a Highway Division session. In the operation of turnpikes a "cardinal principle has emerged." The motorist finds it distasteful to leave a major highway for food, fuel, lodging, comfort facilities, and other services, particularly in strange territory, and at night. These services must be provided on the turnpike, or signs should indicate "that acceptable services can be reached along a well-maintained and marked route."

At a dinner meeting, sponsored by the newly organized Pipeline Division on the first evening of the convention, George D. Hartley, A.M. ASCE, construction engineer for the Arabian American Oil Co. in Saudi Arabia, spoke on construction methods. In 1955 about 7 percent of the free world's oil supply was produced in Saudi Arabia. Aramco supplies its markets using both pipelines and tankers. A 1,200-mile line extending from well fields near and in the Persian Gulf to Sidon in Lebanon, on the Mediterranean, carries oil to tankers. Arab contractors, supervised by Aramco personnel, have rapidly developed competence in pipeline construction, and Arab personnel have been taught adequate manual skills. "Construction methods," Mr. Hartley told his audience, "follow established procedures and methods developed in the United States. Heavy-duty equipment in use is primarily of U. S. manufacture."

Two papers sponsored by the Power Division reported on the construction of another overseas project, just completed by the International Division of Ebasco Services, Inc., the Peixoto hydroelectric power project located on the Rio Grande of Brazil, 216 miles north of Sao Paulo. Two Ebasco men—J. F. Pett, A.M. ASCE, hydraulic engineer, and Reidar Olafsen, M. ASCE, project engineer—explained the financing, design, and construction of a big concrete dam and the installation of the first two 40,000-kw power units which will supply electric energy to power-hungry Brazil. An article about this Latin-American project will be published in a coming issue of CIVIL ENGINEERING.

Authors' Breakfasts

Each morning the 50 to 60 authors of all papers to be presented during the day met for breakfast with the presiding officers and monitors of each session as guests of the Mid-South Section. Here the authors were briefed and projection equipment requirements were checked. The chairman of the Technical Program Committee, capable Willard J. Turnbull, presided at the Authors' Breakfasts assisted by hard-working Eugene P. Fortson, Jr. These briefing breakfasts have proved invaluable aids to smooth-running conventions in the few years since the Los Angeles Convention where they were instituted, and have become standard practice.

Student Counseling

A five-man panel discussion of the Department of Conditions of Practice, sponsored by the Committee on Engineering Education, undertook to shed guiding light on how to attract suitable high school students to the civil engineering profession. A fine example of long-range counseling is the work of the San Diego Engineering Council, formed in 1947, with the San Diego Section of ASCE as the prime mover. On the basis of this close contact and experience with this operation in San Diego, former ASCE Director M. J. Shelton, vice-chairman of the ASCE Committee on Engineering Education, declared in a

Examining a pocket soil-compression instrument in front of Waterways Experiment Station exhibit are four postgraduate (Point IV exchange) students from University of Oklahoma: J. Nery Ferrar, waterworks engineer, Baguio, P. I.; Abass Zedhi, chief engineer of water supply, Tripoli, Lebanon; Iraj Zandi, chief sanitary engineer, Isfahan State, Teheran, Iran; and Ahmed Osman, chief public health inspector, Bilharzia Section, Cairo, Egypt. At the Publication Center Harold T. Larsen (right in view above), manager of ASCE Technical Publications, shows latest Division Journal to Charles V. Prouty, of University of Mississippi Student Chapter.

Large delegation of civil engineers on staff of Humble Oil & Refining Company in Texas attends Convention. Seated, left to right, are Dan Mendell, Jr., H. N. Stamper, J. B. Alexander, H. E. Meadows, and R. A. Rait; standing, in second row, are J. T. Murff, J. C. Denney, H. P. Bezner, S. J. Lewis, and T. E. Mings; standing, in third row, are N. J. Campbell, F. S. Godbold III, C. G. Killian, W. A. Schaefer, W. S. Westerfeld, and G. R. Norfleet, Jr.; and standing, in fourth row, are E. A. Bullington, M. H. Cunningham, R. F. Carroll, E. C. Clark, Jr., R. E. Lane, and A. L. Guy, Jr.

stimulating paper that, "The Committee found it necessary to attack the problem long before the student arrives in high school. First efforts should be directed at the fourth and fifth grades and next at the eight and ninth grades, at which time the student is readily interested and often shows great ability. Mr. Shelton's paper is scheduled for an early issue of CIVIL ENGINEERING.

Moderator Elmer K. Timby, M. ASCE, summed up by declaring that students, their parents, and their teachers need and will welcome the guidance that practicing civil engineers can give.

Students and Their Advisers Meet

Students (250 of them) from ten engineering colleges attended the Convention and were invited to join in all the activities that they could absorb. On Wednesday morning, a typical Mid-South Section student paper contest was conducted, with Eugene F. Bespalow, M. ASCE, the presiding officer. Three cash prizes, provided by the Trippeer Foundation, were awarded: First prize of $30 to B. J. Sellers, of the ASCE Student Chapter at Mississippi State College; second prize of $20 to W. J. Shireman, of the University of Arkansas Chapter; and third prize of $10 to J. L. Paris, of the University of Mississippi chapter.

The all-day conference of the Faculty Advisers of 17 Southern Chapters was devoted to improving Student Chapter activities.

In summary, the Jackson Convention ran true to President Lockwood's description of a typical ASCE Convention. Eleven Technical Divisions held 36 sessions (requiring space in two of Jackson's large hotels), in which 147 authors and speakers presented papers. Before and after the Convention eleven Board of Direction committees and fourteen Technical Division Committees conducted business assigned to them. Between all these were sandwiched in five inspection tours and eight luncheons, dinners, parties, and other entertainment functions. It was a busy week, but there was a lot of fun.

To prepare for a Convention is a year-long task. Mid-South Section President Roy W. Sauer assigned the chairmanship of the General Committee to Sydney W. Chandler. With charming Mrs. Chandler rested the responsibility for planning for the entertainment of the ladies in Jackson and their tea at the Governor's Mansion. The Steering Committee was headed by ASCE Vice-President Norman R. Moore, whose gracious wife was in charge of the ladies trip to the Waterways Experiment Station in Vicksburg, and the tea at the home of General and Mrs. Hardin. Those named here have passed on the credit to the scores who served on the many committees that made the Convention the success it was. The Board of Direction has formally thanked all of them individually.

Echoes from the Jackson Convention

No one who has attended a Convention of the Society can fail to be impressed by the vast amount of volunteer labor involved in both the planning and final stages. It has been estimated that from the opening of the Registration Desk at a Convention to its final closing at the end of a long and hectic week, a minimum of five thousand man-hours and "lady-hours" is required. In devotion to the principles of hospitality, as well as efficiency, the workers for the Jackson Convention certainly extended themselves. From the governor of the state and the mayor of Jackson down through the rank and file, Mississippi was attentive to each individual engineer visitor during Convention week.

An instance of this special devotion arose in connection with preparing the Society's shield which served as table decorations during the Governor's Luncheon. In full color, and measuring five inches high, two shields appeared back to back at two hundred luncheon table settings. It deserves to be recorded that these were the free-will contribution of Floyd Mobley, of the Vicksburg Laboratory of the Waterways Experiment Station. Mr. Mobley is not an engineer and, therefore, not a member of the Society, but when the local committee found it difficult to secure a printer who could do the complex color work required, it was Mr. Mobley who prepared two hundred of the shields piece by piece, working throughout noon hours and unnamed evening spare-time hours, so that with his contribution the Convention would be a success. This sacrificial act is a symbol of the attitude of the entire local working committee.

Multiple-Purpose River Development Symposium

The Society has available a limited supply of reprints of the Symposium on Multiple-Purpose River Development, which was one of the high spots of the Knoxville Convention program last June. All six papers comprising the symposium have appeared in CIVIL ENGINEERING. The list of authors includes ASCE Past-President Gail Hathaway, Special Assistant to the Chief of Engineers; Brig. Gen. Herbert D. Vogel, chairman of the TVA board; and W. A. Dexheimer, U. S. Commissioner of Reclamation. Copies, priced at 50 cents each, may be obtained from the Executive Secretary.

What the Board Did at Jackson

Action on Salaries, Fees, and Legislative Activity Approved

During the Jackson Convention the Board of Direction met in the Heidleberg Hotel on February 18, 19 and 21, with every member present and with President Lockwood in the chair. A number of important actions were taken. Among them are the following:

Department of Conditions of Practice

The Executive Committee (Vice-President Holcomb, chairman, reporting) recommended and the Board concurred in principle the inclusion of "changed conditions" clauses principally in contracts awarded by state and local agencies. AGC, also, is urging the use of "changed conditions" clauses.

The chairman stated that the 1957 Salary Survey is under way, with more than 200 completed questionnaires already returned. First questionnaires in connection with the continuing Salary Index have been sent to 40 engineering firms and 15 state highway departments. Progress to date is recorded on another page of this department.

A Task Committee on *Study of Economic Advancement Objectives* was appointed by the Board at its October 24-25, 1955, meeting. This seven-man committee was directed to "make a complete new study and investigation as to what the Society can do to improve the economic status of its members . . . to be a *positive* approach to the problem . . . rather than what it *cannot* do, such study to determine the effect of the recommendations [the Committee might make] on the tax status of the Society and its relations with EJC and UET. . . . Headquarters staff and the Society's legal counsel are instructed to assist the task committee."

In making the committee's interim report to the Board, Chairman Lloyd D. Knapp pointed out that legal counsel had concluded his extensive findings by stating that, "The Society, and probably its District and Regional Councils and Local Sections, can recommend salary scales or fee schedules without jeopardizing its tax status." This opinion of our attorney does not imply the permissibility of attempts to enforce the recommendations.

With respect to engaging in legislative activity on the part of the Society, our attorney concluded "that the Society, even under its present [tax] classification, could engage in attempts to influence legislation if the legislation were closely connected with the purposes of the Society, [and] if the sum total of the activity" could be proved, on a time and expense basis to be *not* substantial.

Because they represent a considerable departure from understandings which have prevailed in the Society for many years, Chairman Knapp cautioned that, in passing these legal conclusions on to the membership, they are not intended to provide carte blanche authority to engage in these significant activities. Local groups should seek advice from Society Headquarters before undertaking them.

The Board approved the following recommendations of the Task Committee to be undertaken by the Society promptly.

1. Establish strong **representation in Washington, D. C.,** immediately under direction of Society Headquarters. At the same time strongly urge EJC to establish an adequate Washington office.

2. **Relay the legal opinions** mentioned above to Local Sections, that is, those concerning recommending salaries and fees, and engaging in legislative activity without jeopardizing the Society's tax status. Make the Society staff available for assistance as needed.

3. **Increase Headquarters staff** soon with personnel highly qualified to render this service to Local Sections.

4. **Engineering Salaries.** Reestablish the practice of providing, when requested, advice and assistance to both employers and groups of employees seeking to develop and establish equitable classification and salary schedules.

5. **Minimum Fee Curves.** The fee curves in Manual No. 29 now in use are believed to be inadequate and not readily applicable to some work. Develop new fee curves through the Committee on Professional Practice.

Other long-range objections included in the Task Committee's Report are being given further study by the Task Committee and by existing standing committees. They concern registration, public relations, Junior Members, unified Local Section action, better salaries for engineering teachers, engineering education, a positive code of ethics, professional relations between employee and employer, unionization of engineers, and the use to be made of the results of the opinion survey of the civil engineering profession being conducted by the Task Committee on Engineering Education.

Engineer officers in military service do not want any selective consideration or promotion opportunities comparable with those extended to medical officers. The training of engineer officers is directed toward combat and operational command, management and staff duties. Less often do they serve in capacities requiring high technical skill in specialized fields.

Doctors and *dentists,* on the other hand, during their military service continue to practice their professions much as in private life. Their command functions are limited to medical units. Under such restricted circumstances it has been found feasible to set up a separate promotion program for them.

On recommendation of the *Committee on Salaries* (Don H. Mattern chairman), the Board voted to make no effort at this time to obtain a similar program for engineer officers.

Conventions and Conferences

Conventions. On recommendation of the Meetings Committee (Vice-President Marston, chairman), invitations were accepted from the Louisiana and Arizona Sections to hold ASCE Conventions in those states. In the following schedule of dates and locations previously established, the New Orleans and Phoenix Conventions are included.

1957 June 3-7, Buffalo, N. Y.
October 14-18, New York, N. Y.

1958 February 24-28, Chicago, Ill.
June 23-28, Portland, Ore.
October 13-17, New York, N.Y.

1959 February 8-13, Los Angeles, Calif.
May 4-8, Cleveland, Ohio
October 19-23, Washington, D. C.

1960 March 7-11, New Orleans, La.
June 19-25, Reno, Nev.
October 9-13, Boston, Mass.

1961 April 10-15, Phoenix, Ariz.

Local Section Conferences. On recommendation of the Committee on Local Sections (Director Paulson, contact member) four Local Section Conferences were scheduled for 1957 at the following locations and times.

March 21-22, Worcester, Mass.
April 25-26, Walla Walla, Wash.
April 30-May 1, San José, Calif.
July 18-19, Grand Rapids, Minn.

Local Section Conferences are being held in conjunction with District Council meetings instead of during ASCE Convention week. (For dates of coming Technical Division Conferences and other ASCE meetings see the listing elsewhere in this department.)

Districts and Zones

A variety of problems will arise at the time the reapportionment of Districts and Zones must be reviewed in 1960 in conformity with Article IV of the Bylaws. The chairman of the committee, Vice-President Marston, stated that a plan is in development which will require each Vice-President to call a conference well before 1960 of the Directors and Local Section presidents in his Zone to secure their participation in studying problems of reapportionment of the membership in their own areas and those immediately adjacent.

Division Activities Committee

On request of the Division, the Board approved the following adjustment of the terms of appointments to the Executive Committee of the Waterways and Harbors Division: Charles M. Wellons (1957); Capt. Lewis C. Coxe (CEC, USN, 1958); Chairman Rufus W. Putnam (1959); Vice-Chairman Roger H. Gilman (1960).

Approval was voted of the appointment of Dr. Dan H. Pletta to the Executive Committee of the Engineering Mechanics Division for the term ending in October 1960 to replace Dr. Clayton Dohrenwend.

The Power Division was authorized to participate as a "cooperating society" in the 1957 American Power Conference in Chicago, March 27-29. A Joint Cooperative Committee of the AASHO-ASCE (Highway Division) was authorized with nominations of personnel to be made by the Division's Executive Committee.

Commendations

Wallet-sized reproductions of the Code of Ethics have been made and distributed to its membership by the Hawaii Section. For this the Section received Board commendation.

For their continuing effective development and processing of papers for publication in Division Journals, the Board commended especially the Waterways and Harbors Division, and the Power Division. For 1956 the Waterways and Harbors Division Journals included 9 percent of the entire technical publication output of the Society, while this Division's enrolled membership was less than 2 percent of all those enrolled for the Journals. Figures for the Power Division are 14 percent of the technical publication output from less than 8 percent of those enrolled for the Journals.

Technical Publications

Director Garrelts, chairman of the Publication Committee, reported that during 1956, 52 Division Journals were printed by twelve of the Divisions, a total of 275 papers. The Official Register for 1957, containing the names of all national committee personnel, was mailed to every member in February.

For the record, Chairman Garrelts reported that about 14,000 members of the Society are still not enrolled in any Technical Division. Probably 8,600 are enrolled in one Division, and 16,400 are enrolled in two. Each member may enroll in two Divisions, entitling him to receive the Journals of the Divisions, in which he is enrolled, automatically and without charge. An enrollment blank appears in each issue of CIVIL ENGINEERING in the department, "Proceedings Available."

Engineering Center

Director Riley, Contact Member for the Task Committee on Engineering Center, reported that:

1. C. E. Davies, secretary of the ASME, has been appointed by the UET Board for part-time service as Coordinator of the Engineering Center Project.
2. All UET Societies have accepted the terms under which the AIChE is to be admitted to UET, with formal details now being negotiated.
3. Cost estimates on reconstruction of the present Engineering Societies Building to provide 333,410 sq ft of space (1981 requirements) indicate a total cost of $8,400,000 exclusive of land.
4. Due to this high cost of reconstructing the present building, a new building in the Grand Central area is believed possible of attainment at a cost not much higher than that of rehabilitating the present property.
5. The Kelly Committee is preparing to launch its fund-raising campaign. UET-member Societies are expecting to embark on their own campaigns following a common pattern to be developed by UET.

Engineers Joint Council

The Board voted to approve:

1. Admission of the American Institute of Consulting Engineers as an Associate Member of EJC
2. Admission of the Society of American Military Engineers as a Constituent Member of EJC

Local Sections

The Board announced its authorization of a Colombia Section to include the entire Republic of Colombia, and of a Northwest Branch of the South Carolina Section.

Engineering Societies Library

Funds required for the operation of the Engineering Societies Library come in part from contributions by the four Founder Societies. By action of the UET Board, monies annually received from the Societies have been merged into one account. Total contributions are based on the same formula as previously in effect, that is, $5,000 plus 40 cents per member of the Society.

American Sanitary Engineering Intersociety Board

President Lockwood reported that he had received a communication from Francis B. Elder, secretary of the American Sanitary Engineering Intersociety Board, under date of October 26, 1956, from which the following extracts are taken: "The Trustees asked me to express to you, as President of the American Society of Civil Engineers, their sincere appreciation and gratification for the strong support given to the Board by the Society . . . Without that money [loan of $7,500] we would never have been able to get started. . . . the cordial and cooperative spirit exhibited by staff members of the Society to the staff of the Board was almost equal reason for satisfaction."

Visits

It was reported that 16 members of the Board had made 56 visits related to Society operations since October 1956: 44 of them to Local Sections and Student Chapters, and 17 of them by President Lockwood. Five members of the Headquarters staff had made 33 visits related to Society operations: 21 of them to Local Sections and Student Chapters, and 17 by Executive Secretary Wisely.

Appreciation to Convention Personnel

In accordance with the wishes of the Board, the Executive Secretary transmitted expressions of thanks and appreciation to all committees and individuals who contributed to the outstanding success of the Jackson Convention.

Drive Is on to Finance United Engineering Center

Fund raising for new United Engineering Center—to be built on an as yet undetermined site in midtown Manhattan—gets off to a good start with a donation from the New York section of the American Institute of Chemical Engineers. Here J. F. Lawrence (second from left), chairman of the New York section of the AIChE, hands $500 check to W. J. Barrett, president of United Engineering Trustees, Inc. At extreme left is T. M. Jackson, Jr., vice-chairman of the AIChE's New York section, and at extreme right W. F. Thompson, chairman of the Real Estate Committee of UET. Target for completion of the project, which will cost some $10,000,000, is 1959. Participating societies, in addition to AIChE, are ASCE, AIEE, ASME, and AIME.

Irrigation and Drainage Conferences Set for San Francisco

The world's leading irrigation engineers will meet in San Francisco this spring for two important conferences—the First Intersociety Conference on Irrigation and Drainage, set for April 29 and 30, and the Third Congress of the International Commission on Irrigation and Drainage, which will extend from May 1 to 4. Both meetings will be in the Sheraton-Palace Hotel.

Man's opportunities to assure the permanence of irrigation agriculture is the topic of sessions arranged for the First Intersociety Conference, which is being sponsored by the ASCE Irrigation and Drainage Division; the Soil and Water Division of the American Society of Agricultural Engineers; and the Conservation, Irrigation, Drainage, and Tillage Division of the Soil Science Society of America. This conference is in cooperation with the U. S. National Committee of the International Commission on Irrigation and Drainage.

Harry F. Blaney, chairman of the executive committee of the ASCE Irrigation and Drainage Division and principal irrigation engineer for the U. S. Department of Agriculture, will be chairman of the First Intersociety Conference. Some 27 papers—segmented into sections on water, crops, soils, and man in a permanent irrigated agriculture—are scheduled for the two-day program.

Third Congress sessions will cover four questions: Canal Lining; Soil-Water Relationship in Irrigation; Hydraulic Structures on Irrigation and Drainage Systems; and Interrelation between Irrigation and Drainage. Nearly 100 papers have been prepared under these topics. Reporters for the four sessions will be Hollis Sanford, U. S. Bureau of Reclamation, for the United States; Baleshwar Nath, Central Board of Irrigation and Power, for India; Dr. M. A. Selim, Permanent Council for Development of Production, for Egypt; and J. Arrighi de Casanova, engineer-in-chief, Rural Development, for France. W. E. Blomgren, M. ASCE, Denver consultant, is chairman of the host United States National Committee; M. R. Lewis, M. ASCE, Oakland consulting engineer, is chairman of the California Steering Committee.

Both groups will enjoy Study Tours, arranged by the Field Trip Committee for May 6-18. These tours will permit inspection of irrigated structures, equipment, lands and institutions from Shasta Dam at the head of the Central Valley to Imperial Valley installations at the Mexican border. M. R. Huberty, A.M. ASCE, chairman of the department of irrigation and soils, University of California, heads the Field Trip Committee. Manufacturing, contracting, and service industries are preparing exhibits in connection with the Third Congress. Information on the Congress may be obtained from the U. S. National Committee, P.O. Box 7826, Denver 15, Colo.

ICID is a technical organization, which provides a sounding board for world problems associated with irrigation and drainage. It was formed in 1950, and the United States became a member in 1952. There are now 37 member nations. The Third Congress is the first to be held in the United States.

Board Commends Hawaii Section

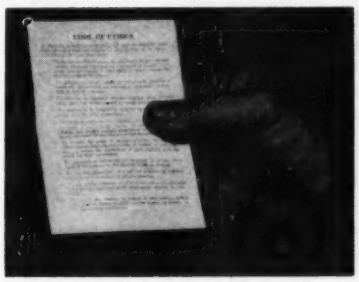
At its Jackson meeting the Board of Direction praised the Hawaii Section for its praiseworthy action in printing the Code of Ethics in wallet-size format and mailing a copy to each of its members for ready reference on the job.

In a letter dated December 27, 1956, Francis Wai, then president of the Section, wrote the following letter in part to the members:

"In these days of intensified engineering activities, there will arise occasions when the engineer must choose between good basic principles and borderline expediency in matters pertaining to his professional conduct. At such times a formulated guide by others who had the same experience should be most beneficial and helpful.

"We draw your attention to such a guide as developed by the American Society of Civil Engineers in the form of the Code of Ethics. . . . A copy is herewith mailed to each one of you as part of the service by your Section this year.

"We hope that you'll like it, and that you'll use it and let it serve as a standard to maintain our profession on the high and ethical plane required in service to mankind. . . ."



ASCE Sponsors Jet Age Airport Conference

Leading representatives of the aviation industry, government spokesmen, and engineers engaged in the field will present important papers at the Jet Age Airport Conference, to be held May 15-17, in the Park-Sheraton Hotel, New York. The Society's Air Transport Division is sponsoring the event which is expected to draw several hundred experts from all over the country according to Joseph D. Blatt, chairman of the Air Transport Division, and Deputy Regional Administrator, New York Office, Civil Aeronautics Administration. Five groups will participate: Manufacturers of jet planes; operators of jet planes; operators of ground facilities; government representatives, including spokesmen for the CAA and the U.S. Air Force; and engineers who design and construct airport facilities.

With the arrival of jet craft less than two years away, the conference is of particular importance. Interest in it has been further stimulated by the recent record-breaking flight of a Boeing 707 turbo jet from Seattle to Baltimore.

Mr. Blatt is chairman of the Conference Committee. The vice-chairmen are Reginald J. Sutherland, of New York, airport facilities engineer for American Airlines, and Prof. Robert Horonjeff, of Berkeley, research engineer for the Institute of Transportation and Traffic Engineering, University of California.

The tentative program follows:

Morning of May 15

Paper on "Noise Level Problems—Jet Transports," by a Boeing representative.

"Operating Characteristics of Turbo-Powered Aircraft—Long Range," by a Douglas Aircraft representative.

"Operating Characteristics of Turbo-Powered Aircraft—Short and Medium Range," by a Convair representative.

"Panel discussion by representatives of Boeing, Douglas and Convair, moderated by William Littlewood, vice-president of equipment research for American Airlines. Professor Horonjeff will be chairman of this session.

It is planned to have an official of the CAA as the luncheon speaker.

The **May 15 afternoon program,** over which Mr. Blatt will preside, will include:

"Traffic Estimates and Their Relation to Airport Financing and Economics," by Kenneth Osterberg, Minneapolis consultant.

"Protection of Airport Approaches," by Chester Bowers, Washington, chief of the Airport Requirements Division of the CAA.

"Jet Aircraft Operations in Terminal Areas, Including Requirements for Ramp Facilities, Manpower, Air, Water," speaker to be announced.

"Terminal Building Functional Design," speaker to be announced.

Morning of May 16, Mr. Sutherland presiding:

"Technique for Establishing Runway Length," by a representative of United Airlines.

"Layout of Runways and Taxiways," by William E. Cullinan, chief of the Airport Division, New York Regional Office of the CAA.

"Airport Pavements," by Willard J. Turnbull, chief of the Soils Division, Corps of Engineers, Waterways Experiment Station, Vicksburg, Miss.

"Airport Maintenance," by a representative of the U.S. Air Force.

The Conference Committee expects as the luncheon speaker the head of a major airline.

The **May 16 afternoon program,** to be presided over by Dewey S. Wright, city engineer of Denver and president of the Colorado Section of ASCE, will include:

"Airport Fueling," by an Air Force spokesman.

"Heliport Requirements," by a CAA representative.

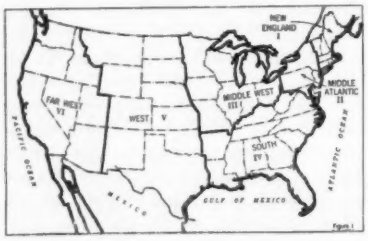
"Basic Airport Planning," by a spokesman for the National Advisory Committee for Aeronautics.

The final day, **May 17,** will be devoted to an inspection tour of the International Airport at Idlewild, where a wide variety of engineering problems and solutions will be studied. The tour will include structures, foundations, construction procedures, area planning, power plant, arrivals building, construction materials and other phases.

New Quarterly Engineering Salary Index

This month CIVIL ENGINEERING begins publication of a new feature, the Quarterly Engineering Salary Index, developed by the Society's Committee on Salaries. Reported for many of the representative engineering centers and state highway departments across the country, the Index will show current trends in engineering salaries and be a valuable supplement to the biennial Salary Survey Report. Initially, the indexes for consulting engineering firms will be kept separate from the highway department indexes for the states.

Base for the new Index is the sum of the 1956 minimum salaries for professional engineering Grades GS-5, -7, and -9 of the Federal Civil Service. These grades correspond to ASCE salary survey Grades I, II, and III. The index equals the sum of the average entrance salaries paid in these three grades, divided by the base. Consulting engineering firm salaries have been selected as the basis for one index because it is believed that such salaries are quite responsive to changes in supply and demand and because data on them are readily available in the key cities. Although not as sensitive to changing conditions as are consulting engineering salaries, an index for state highway departments likewise is of primary interest these days because of the magnitude of the Federal Interstate Highway Program just getting under way.



The cooperating organizations supplying salary data, which must necessarily remain anonymous, have been carefully selected as representative organizations in their respective areas. In so far as practical, the Committee on Salaries intends to continue using these sources to insure continuity of data from one report to another. The present plan is to revise the Index quarterly. However, should experience show that changes on a quarterly basis are insufficient to justify this frequency, the interval between indexes may be increased.

The Committee on Salaries expects that the Index, together with the salary survey reports, will prove invaluable to employees and employers alike in arriving at equitable salary schedules. It is noted that while the Index is intended to reflect civil engineering rates only, many of the cooperating firms employ electrical and mechanical engineers as well, the net effect being that the Index will actually show salary changes in all branches with reasonable accuracy.

The Engineering Salary Indexes for consulting engineering firms in the different cities, listed in the following tables, are based on salaries in effect on February 15, 1957.

Atlanta	— 1.10	New Orleans	— 1.00
Baltimore	— 1.02	New York	— 1.11
Boston	— 1.07	Pittsburgh	— 1.05
Chicago	— 1.06	Portland	— 1.06
Denver	— 1.04	San Francisco	— 1.09
Kansas City	— 1.06	Seattle	— 1.05
Los Angeles	— 1.14		

Other centers of engineering activity will be included as contacts are made with a sufficient number of representative organizations in each city. The Committee believes that data on highway salaries can best be shown on a regional basis, and we have so grouped them in the following summary:

Region I, New England	— 0.96
Region II, Middle Atlantic	— 1.06
Region III, Middle West	— 1.02
Region IV, South	— 1.09
Region V, West	— 0.84
Region VI, Far West	— 1.08

The area included in each of the different regions is shown in the accompanying map. This division of the country into regions is the same as that used in the biennial salary survey.

The wholehearted cooperation received from the participating organizations has been most gratifying to the Committee. Even firms where employee salary policies were not adaptable to inclusion under ASCE classifications for one reason or another, expressed interest and stated that they would be glad to help in any way possible.

ASCE MEMBERSHIP AS OF March 8, 1957

Members	9,356
Associate Members	12,458
Junior Members	17,527
Affiliates	73
Honorary Members	44
Total	39,458
(March 9, last year	38,695)

ASCE CONVENTIONS

BUFFALO CONVENTION
Buffalo, N. Y.
Hotel Statler
June 3-7, 1957

ANNUAL CONVENTION
New York, N. Y.
Hotel Statler
October 14-18

CHICAGO CONVENTION
Chicago, Ill.
Sherman Hotel
February 24-28, 1958

TECHNICAL DIVISION MEETINGS

TECHNICAL PROCEDURE CONFERENCE
Oklahoma City, Okla.
Hotel Skirvin
April 12-13

INTERSOCIETY CONFERENCE ON IRRIGATION & DRAINAGE
San Francisco, Calif.
Sheraton-Palace Hotel
April 29-30
Sponsored by
ASCE Irrigation & Drainage Division
Am. Soc. of Agricultural Engineers
Soil Science Society of America

AIR TRANSPORT CONFERENCE
New York, N. Y.
Park Sheraton Hotel
May 15-17

STRUCTURAL PRESTRESSED CONCRETE CONFERENCE
San Francisco, Calif.
Fairmont Hotel
July 29-August 2

HYDRAULICS CONFERENCE
Cambridge, Mass.
Mass. Inst. of Tech.
August 26-28

WATERWAYS & HARBORS CONFERENCE
Princeton, N. J.
October 18
(Part of Annual Convention program)

DISTRICT COUNCIL CONFERENCES

DISTRICT 9 COUNCIL
Columbus, Ohio
Deshler-Hilton Hotel
April 12-13

PACIFIC NORTHWEST CONFERENCE
Walla Walla, Wash.
Marcus Whitman Hotel
April 26-27
and
Local Section Conference
April 24 and 25

PACIFIC SOUTHWEST CONFERENCE
San Jose, Calif.
Hotel Sainte Claire
May 2-4
and
Local Section Conference
April 30-May 1

LOCAL SECTION MEETINGS

Hawaii—Annual all-day spring conference at the Hawaiian Village Hotel, Waikiki, Oahu, May 15. With the theme of irrigation, the event is especially arranged for the convenience of engineers in San Francisco to attend the Intersociety Conference on Irrigation and Drainage and the Third World Congress on Irrigation and Drainage.

Los Angeles—Dinner meeting of the Sanitary Group at the Engineers Club, Los Angeles, April 17, at 6:30 p.m.; dinner meeting of the San Bernardino-Riverside Counties Branch at Mike's Grill, 3326 Market Street, Riverside, Calif., April 18. For dinner reservations write to L. A. Coleman, P.O. Box 697, Cucamonga.

Metropolitan—Meeting in the Auditorium of the Engineering Societies Building, New York, April 17, at 7 p.m.

Mid-South—Annual spring meeting at the Hotel Claridge, Memphis, Tenn., April 25-27, with the Memphis Branch as host.

Mohawk-Hudson—Tentative joint meeting with the Connecticut Section at West Point, N. Y., on May 21.

Sacramento—Weekly luncheon meetings at the Elks Temple every Tuesday at 12 noon.

Syracuse—Annual dinner-dance at Drumlins Country Club in Syracuse, April 27. ASCE Director Carey Brown will be among the guest speakers. The first in a series of annual awards will be made to an outstanding civil engineer in the area.

Tennessee Valley—Spring meeting at the Manor in Asheville, N. C., May 17 and 18, with the Asheville Branch as host.

Texas—Spring meeting at the Lubbock Hotel, Lubbock, Tex., April 25-27.

Wisconsin—Dinner meeting at the Ace of Clubs, Madison, April 25, to be devoted to prestressed concrete bridges.

NOTES FROM THE LOCAL SECTIONS

(Copy for these columns must be received by the fifth of the month preceding date of publication)

New **Akron Section** officers—elected at the January 17 meeting—are Myron S. Raudebaugh, Sr., president; Alfred Seese, Jr., vice-president; and Norman R. Cox, secretary-treasurer. Featured speaker was W. R. Langrill, Cleveland manager of the Raymond Concrete Pile Co., who showed a film on construction of the first Texas Tower in the Atlantic and commented appropriately.

A good turnout for and "fine response" to the **Arizona Section's** all-day meeting in Yuma on February 2 is reported by Angelo Dalcerro, Yuma meeting chairman. The Society was represented on the program by Director R. Robinson Rowe ("who drove exactly 1,000 miles to attend") and Finley Laverty, Director for District 11.

The building of the Bell Telephone System's Transatlantic Cable was described in an engrossing talk highlighting the **Central Ohio Section's** January meeting. The speaker was Edward Chapman, of the Ohio Bell Telephone Company. All hands are busy getting ready for the conference of the District 9 Council, which is being held in Columbus, April 12 and 13, with the Section as host.

The **Cincinnati Section's** annual joint meeting with the University of Cincinnati Student Chapter—held at the University of Cincinnati on February 6—featured a paper by sophomore student David A. Sommers. Mr. Sommers' talk and slides covered some aspects of the St. Lawrence Seaway, based on his observations as an employee on the project for the Corps of Engineers. Howard B. Luther, professor of civil engineering at the University of Cincinnati, received his Life Membership Certificate. Three other Cincinnati engineers—Warren W. Parks, R. M. Miller, and George E. Oliver—received their certificates at the Section's January meeting (March issue, page 78).

At the helm of the **Dayton Section** this year are William Apple, president; Louis A. Nees, first vice-president; William T. Eiffert, second vice-president; and DeFro Tossey, secretary-treasurer. Paul Osweiler is Section representative on the District 9 Council.

The railroad industry was the theme of the **Georgia Section's** March meeting. Guest speakers were Howard C. Forman, chief engineer of the Louisville & Nashville Railroad Co., and George H. Echols, chief engineer of the Southern Railway System. Mr. Forman dealt with the Hills Park Retarder Yard, a current construction project of the Louisville & Nashville and the Nashville, Chattanooga & St. Louis Railway. Mr. Echols discussed some of the maintenance problems being solved by the industry today. George B. Weston, chief engineer of the Mobile District of the Corps of Engineers, spoke at the February meeting of the **Albany Branch** on construction of the Fort Gaines Dam. The **Central Savannah River Valley Branch** joined the South Carolina Society of Engineers for its January meeting in North Augusta, S. C. Kenneth Hora gave an illustrated talk on the transistor and the solar battery.

Executive Secretary W. H. Wisely (at left) and ASCE Vice-President Frank A. Marston (at right) attend the Massachusetts Section's annual meeting, held at the M.I.T. Faculty Club on January 28. They flank the Section's new officers (shown in usual order): A. Russell Barnes, Jr., president; John J. Cusack, secretary-treasurer; and Prof. Ernest L. Spencer, vice-president.

Under the capable leadership of Frank W. Edwards, plans for the Society's 1958 Chicago Convention are rapidly taking shape, the **Illinois Section** reports. Both the **Tri-City** and **Central Illinois Sections** will be hosts with the Illinois Section, and it is the aim of the joint group to attract over 2,000 to this important spring Convention. The dates are February 24-28, and the headquarters the Sherman Hotel. Mr. Edwards is an old hand at running conventions, having steered the ASCE Centennial Celebration. Mrs. Virgil Gunlock is in charge of the Women's Program for the Chicago Convention.

Insurance and its application to engineering construction was the topic at the **Iowa Section's** February meeting—a joint session in Des Moines with the Iowa Engineering Society. Featured speaker was Edward J. McDuff, resident manager for the Maryland Casualty Company at Des Moines. Society activities were reported by E. S. Kirkpatrick, assistant to the Secretary of ASCE. During the evening the Section awarded prizes, consisting of ASCE entrance fees as Junior Members, to two students—Wayne C. Irelan, of Iowa State College, and Dewey R. Andersen, of Iowa State University.

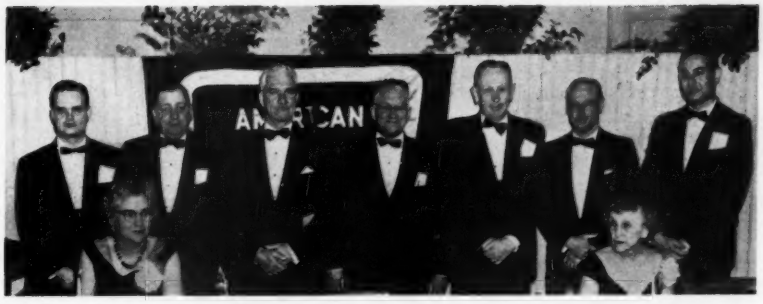
Tight money conditions, resulting in higher interest rates, may continue for sometime, and government agencies will need to arrange their bond issues to meet market conditions. This is the opinion of Robert B. Fizzell, senior member of a firm of Kansas City attorneys specializing in the municipal bond field. In the leading talk at the **Kansas City Section's** February meeting, Mr. Fizzell discussed the financial side of municipal improvement works, with special reference to requirements for financing by revenue bonds. He emphasized the importance of

careful engineering appraisal of project revenues and the soundness of planning to meet future contingencies. According to Mr. Fizzell, cities can maintain a much better credit position by adopting revenue bond issues for financing all revenue-producing improvements. There was a turnout of 175 to hear Mr. Fizzell.

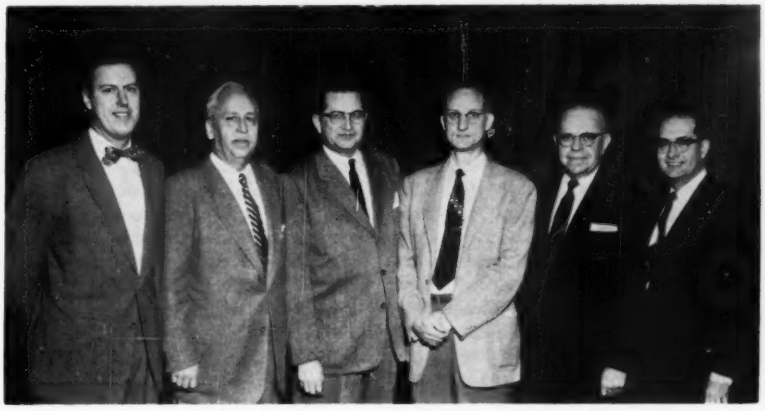
The **Kansas Section's** 1957 slate—elected at a meeting on January 21—is Elwood R. Leeson, president; Walter F. Robohn, vice-president; and Dale E. Dugan, secretary-treasurer. The program featured presentation of a Life Membership Certificate to Thomas Burton. An informative talk on engineering progress in Kansas—given by C. C. Kilker, of the State Chamber of Commerce—was enjoyed at the February meeting. Mr. Kilker observed that the state's problems are bound to be increasingly complex in the future and to require the efforts of the engineering profession for solution, and urged his hearers to accept the challenge. He emphasized that Kansas can no longer look to the land as prime source of its wealth, but must intensify efforts to attract new industry to the state.

The new Walt Whitman suspension bridge over the Delaware between Philadelphia and Gloucester, N. J., was the program topic at the **Lehigh Valley Section's** February 18 meeting—a joint session with the Lehigh University Student Chapter. Milton Brumer, associate partner in the New York consulting firm of Ammann & Whitney, covered the design of the main span and approach structures; and C. W. Hanson, partner in the Harrisburg consulting firm of Modjeski & Masters, reviewed the development and financing and discussed the design of the foundations. Construction of the six-mile-long $90,000,000 project was illustrated with slides and a movie.

On January 23 the **Metropolitan Section** had a party at the Engineers Club for its new life members. President David Baillie was host for the Section, and the Life Membership Certificates were presented by Prof. Jewell Garrelts, ASCE Director for District 1. Among those who turned out to meet and congratulate the distinguished group was Commissioner Irving V. A. Huie, who originated the idea of an annual reception for life members over ten years ago when he was president of the Section. The 26 honored included ASCE Past-President Enoch R. Needles, who was away from the city on a business trip and unable to attend the reception. In a happily phrased letter, read at the close of the presentations, Mr. Needles said in part: "One of my greatest inspirations of the past year came from being privileged to hand out these certificates to other of our Life Members at several different meetings over the country. Thus the twinges of regret become all the sharper that I cannot be present in person for my induction into the ripest and richest membership class of our Society. Without taking away from any of the younger members one small particle of their true deserts. I like to believe that I am passing into the fellowship of the aristocracy of our civil engineering profession."



Federal Highway Administrator Bertram D. Tallamy and ASCE President Mason G. Lockwood were featured speakers at the National Capital Section's annual dinner held at the Army-Navy Country Club on February 12. Seated are Mrs. Daniel B. Ventres and Mrs. Leo Colbert, wife of ASCE Honorary Member, Admiral Leo Colbert, who was seated at head table outside camera range. Standing, in usual order, are James J. Stout, treasurer of Section; James H. Carr, Jr., vice-president of Section; Federal Highway Administrator Tallamy; Section President Daniel B. Ventres; ASCE President Mason Lockwood; Mason C. Prichard, Director for District 5; and Alfred R. Golze, secretary of the Section. During the evening President Lockwood awarded Life Membership Certificates to eighteen Section members. Among those present to receive their certificates were Robert S. DuBois, Harold F. Clemmer, Henry W. Hemple, Clifford A. Betts, Charles M. Andrews, and William H. Richards.



New St. Louis Section officers turn out for their first meeting, which took place on January 28. Reading from left to right, they are Robert D. Bay, secretary; Henry S. Miller, vice-president; W. J. Hedley, ASCE Director for District 14; Eldred B. Murer, president; Verna C. Hanna, vice-president; and Lawrence P. Roth, treasurer. Mr. Hedley spoke on recent Society activities in their relation to the Section. The Section is involved in a number of studies of importance to engineers, contractors, and architects of the area, and reports of these activities were given by chairmen of committees reviewing the new B.O.C.A. building code under consideration for the city.

New **Miami Section** officers are F.D.R. Park, president; George Watson, vice-president; David B. Preston, secretary; and Howard M. Post, treasurer. Causes

and prevention of beach erosion in the Granada Island area were discussed at the section's January 3 meeting by M. N. Lipp, chief engineer and assistant city manager of Miami Beach. Bayard Snow, prominent Section member and chief of the sanitary department of Rader and Associates, Miami, received a Life Membership Certificate on February 20 during the annual Engineers Week dinner and celebration.

President Mason Lockwood and Vice-President Francis Friel were guests of the **Pittsburgh Section** at its annual dinner meeting on February 4. Both spoke inspiringly—Mr. Friel on the engineer's responsibilities and Mr. Lockwood on an interesting evaluation of the profession entitled "Engineering Is People." Life Membership certificates were presented to Alois H. Doering and John R. Herbert. The new slate of officers, inducted during the evening, was listed in the February issue (page 74). New Junior Forum officers are Archie J. Merritt, president, and Joseph W. Miorelli, secretary-treasurer.

Two speakers, who shared the platform at the **San Francisco Section's** February meeting, presented a program on modern digital computers that stripped some of the mystery from these formidable devices. They were Dr. Melvin A. Shader, district coordinator of applied science of International Business Machines, and Sam Osofosky, supervising highway statistician for the California Division of Highways. Dr. Shader discussed general aspects, while Mr. Osofsky gave examples of specific applications of computers to engineering problems and outlined the changes that must be made in the customary approach to engineering computation to put the problem in a form for feeding to a digital computer. Appetites for more information on the subject of computers were further whetted by Lyle Hoag's fascinating discussion of the application of the IBM 650 to the analysis of the water distribution network of the City of Palo Alto. Dr. Shader acted as consultant to Mr. Hoag on the project.

For the **Southern Idaho Section** the new slate is John D. Griffiths, president; Boyd Austin, first vice-president; Melvin V. Davenport, second vice-president; Carl L. Lawrence, secretary; and Fletcher W. Pearce, treasurer.

The program at the February 11 dinner meeting of the **Texas Section's San Antonio Branch** was devoted to a report on the San Antonio sewage disposal plant. Plans are being made to increase present plant capacity from 57 to 69 mgd. Plant capacity in 1930 was only 25 mgd. Guest speakers were Bill Wells, plant superintendent, and F. T. Drought, who summarized his recent report to the city outlining the requirements of a proposed master sewer plan for the city. Frank S. Walters has been appointed Junior Contact Member for the Branch.

District 10 Council Meets in Chattanooga

The District 10 Council—meeting in Chattanooga, Tenn., March 1 and 2—spent two days in interesting and fruitful discussion of such subjects as "Prestige of the Engineering Profession," "Unionization of Engineers," "How Can Consulting Firms Aid State Highway Departments in the National Road Program," and "What Can Be Done to Interest Students in Engineering." The discussions and decisions reached resulted in a series of resolutions to the Board of Direction of ASCE.

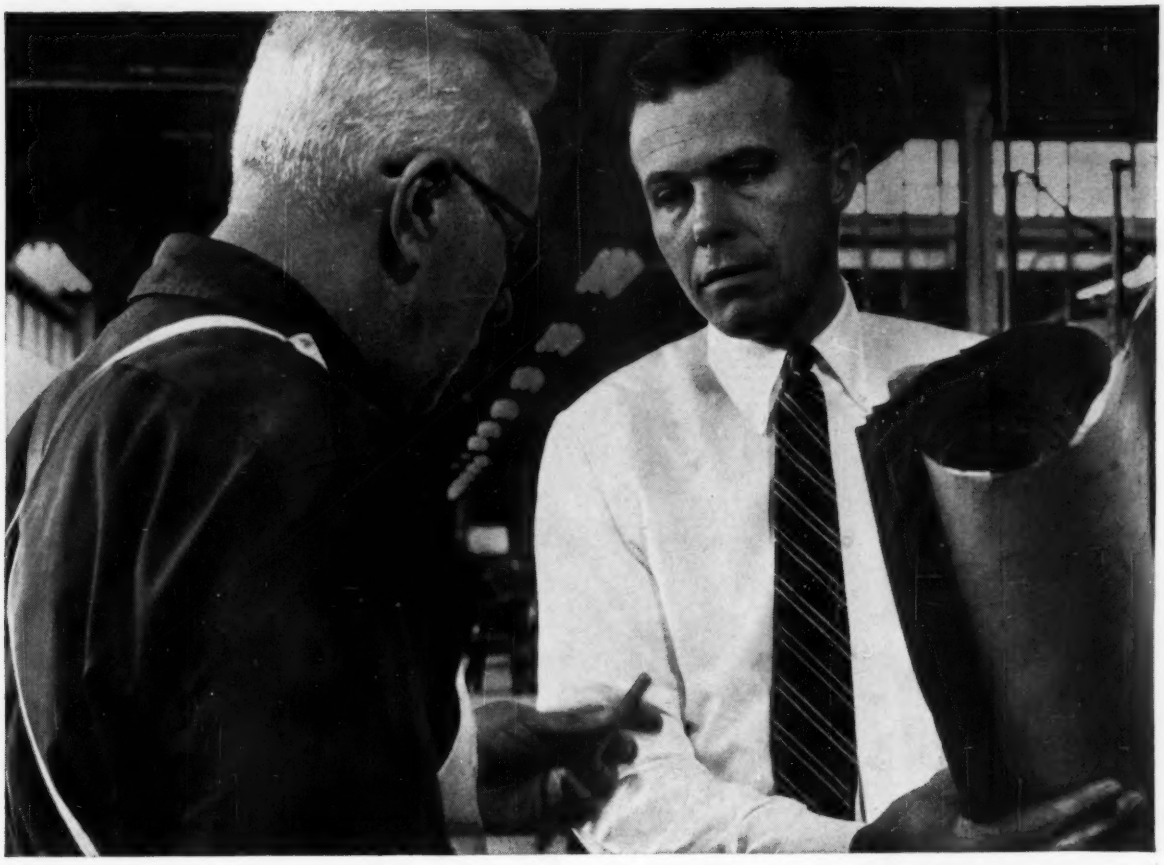
These resolutions recommended that ASCE continue support of EJC-ECPD participation in a comprehensive survey of the engineering profession; that the Board encourage in every way maximum utilization of consulting engineering firms in the implementation of the Federal Highway Program in cooperation with existing agencies, and that latitude be permitted private enterprise in the exercise of engineering skills commensurate with the requirements of economy and public safety; and that ASCE use every effort to bring the shortage of engineers and lack of needed teachers to the attention of the membership and the public at large, with a view to correcting the deficiencies threatening national security.

President Lockwood spoke briefly at a joint dinner meeting with the Chattanooga Branch, stressing the need for communication between ASCE Headquarters and the "grass roots" level of the Society. Vice-President Francis S. Friel, of Philadelphia, made the principal address on "Obligations of the Engineering Profession." He emphasized that we must accept the responsibilities of all professional men by the kind of work we do and the reputation we make. We must accept our responsibility to teach the profession to others and take an interest in the teaching profession and the physical plant of colleges of engineering, Mr. Friel declared. He also urged that industry contribute funds to the colleges since twice the facilities now in use will be needed by 1970.

The Council endorsed Don H. Mattern, chief of the Project Planning Branch of the Tennessee Valley Authority, to succeed to the office of District 10 Director being vacated by Graham P. Willoughby. Mr. Mattern has long been an active member of the Knoxville Branch and was general chairman of the Society Convention held in Knoxville last June.

The Council accepted the invitation of the Georgia Section to hold its 1958 meeting in Atlanta next spring. The North Carolina delegate extended an invitation to hold the 1959 meeting in Charlotte, N. C.

Official delegates to District 10 Council meeting, held in Chattanooga on March 1, are (seated, left to right) William R. McLean, member of the T. V. Section and chairman of the District 10 Council; Francis S. Friel, Vice-President, Zone II, Philadelphia; and Walter E. Mooney, secretary-treasurer of District 10 Council. Standing are C. E. Kindsvater, Georgia Section; Louis C. Daugherty, Nashville Section; Joseph P. Bouquard, T.V. Section; James F. Pou, North Carolina Section; James M. Faircloth, Alabama Section; Albert E. Johnson, South Carolina Section; James F. Shivler, Florida Section; and George E. Watson, Miami Section. Delegates were present from all eight Sections in the District 10 Council.



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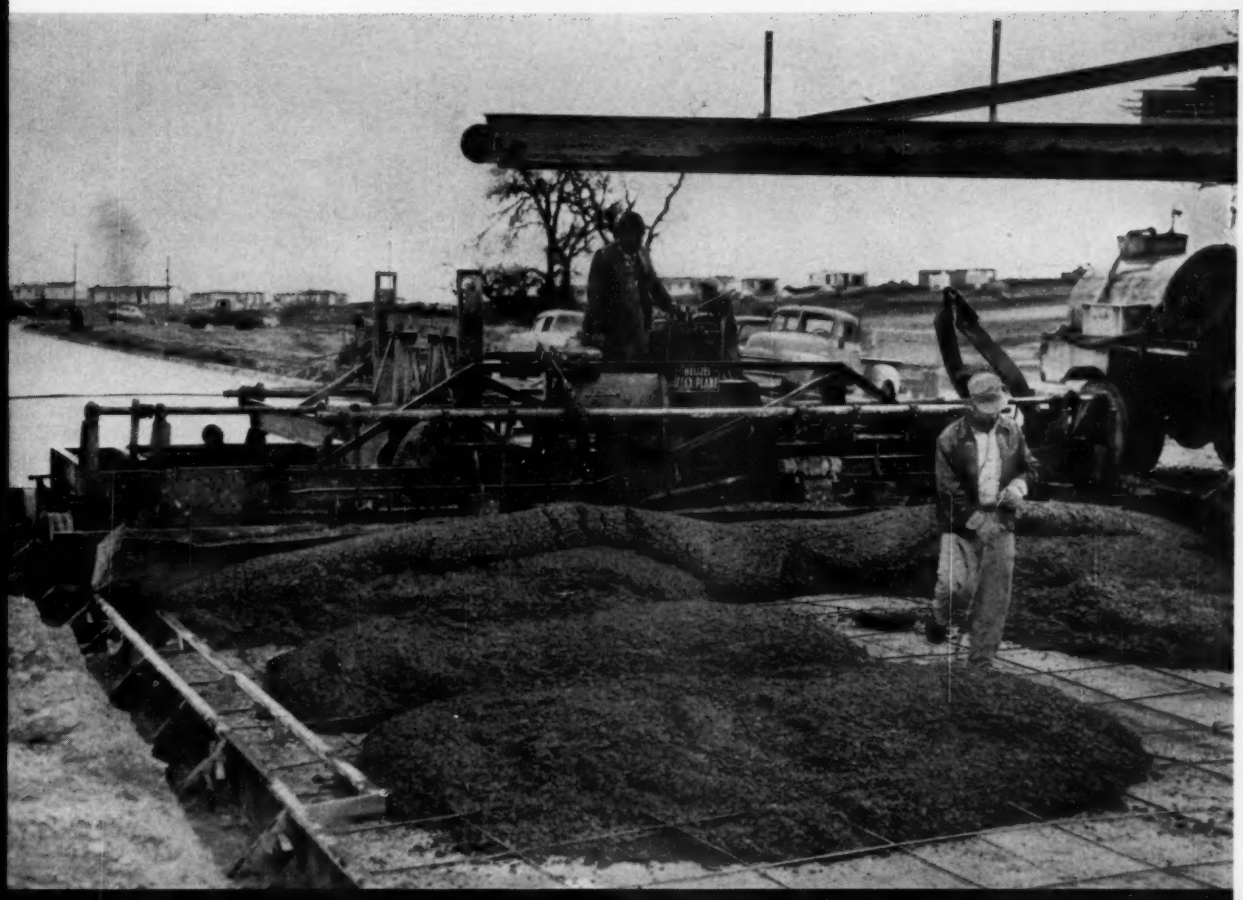

TEXAS CITY STREETS Contractor reported highest pouring ever. Credits Flex-Plane. Note amount of concrete in front of screed here.

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BY-LINE WASHINGTON . . . . .

The expanding use of aerial photography for highway location was reviewed last month at a crowded assembly of photogrammetry experts in Washington for the annual convention of the American Society of Photogrammetry. An unprecedented number of highway engineers were on hand to pick up current applications of the short-cut surveying technique. They heard William T. Pryor, chief of aerial surveying for the Bureau of Public Roads, declare that the fullest possible use of photogrammetry must be employed in getting the National Highway Program underway.

Congress, in drafting the expanded roadbuilding program, explicitly called for the use of aerial surveying to lighten the mapping load involved in the road program. Experts believe locating the 41,000-mile National Interstate System, 75 per cent of which must be on new routes, will provide the real test of aerial engineering over the next few years.

* * *

A fistful of bills has been introduced in both the House and Senate to revise the Federal Aid Highway Act of 1956. They cover a wide range of proposals—reorganization of the Department of Commerce to administer the Act, imposition of speed limits, addition of mileage to the Interstate System, and control of billboard advertising.

The 1956 Act added 1,000 miles to the Interstate System, posing some hard decisions for the Bureau of Public Roads. (The BPR has already received requests from almost all the states for portions totalling 12,000 miles. Officials expect to have a decision on the new mileage within the next few days.) But there is increasing pressure to expand the System even more. A number of Congressmen have openly declared that more mileage is urgently needed in their states.

Most national highway experts would prefer to see a good start toward completion of the initial 41,000-mile framework before proposals to enlarge it are entertained. But the prospect of 90 percent federal aid is too much for the congressmen to resist. Many are determined to see their pet projects added to the System as quickly as possible.

Also hot on the griddle are several bills to limit billboards on the Interstate System. People who would like to see the superhighways designed with an eye to beauty are up in arms over the apparent weakness of the 1956 Act in this respect. They want federal regulations prohibiting billboard advertising within 500-600 ft of the new roads. Hearings are being planned.

A bill to compromise the strict clearance requirements established by the Corps of Engineers for bridges over navigable streams has been introduced in the Senate. Senator Dennis Chavez, who drafted the measure, believes that the Corps must give greater consideration to the additional cost of building higher level structures and to the equal rights of surface transportation using the bridge.

The feasibility of constructing heliports in connection with the National Interstate System would be studied by the Department of Commerce in a bill proposed by Congressman George Fallon, chairman of the House Subcommittee on Roads. Mr. Fallon is convinced that sites on or near the highway rights of way for such facilities could be acquired easily now and at a reasonable cost (estimated $40,000) and provision made for built-in heliports when the need arises. He sees the use of helicopters helping to break traffic bottlenecks in urban areas particularly.

* * *

In an attempt to simplify highway paving technology, the Asphalt Institute has recommended reducing the number of grades of paving asphalts from nine to five. The new grades are 40-50 penetration (mostly for industrial uses), 60-70, 85-100, 120-150, and 200-300. The Institute is still pursuing plans to reduce the number of grades of rapid-curing, medium-curing, and slow-curing groups of liquid asphalt, also. Such streamlining of materials specification has been hailed as one way to ease the engineering chore involved in the accelerated road program.

* * *

The virtual collapse of the federal government's lease-purchase building program was the subject of puzzled inquiry last month. The $700-million program, involving 150 projects around the country, was dropped recently by General Services Administrator Franklin Floete. He announced that only one structure had reached the construction stage under the scheme and blamed "inflationary pressures" for the failure of active bidding for lease-purchase jobs. Others blamed the low interest rate of 4 percent for the failure of the program to rouse the interest of private financiers.

Two Congressmen have suggested drastic remedial measures. Senator Francis Case has recommended creation of a new, independent federal agency empowered to finance not only the government buildings, but school houses as well. Senator Case would finance his government buildings program by issuance of $5 billion worth of revenue bonds. Congressman Robert Jones has introduced a bill which would repeal the lease-purchase arrangement entirely and return the federal government to the practice of financing each project individually through direct appropriation.

* * *

All the state highway departments are concurring with a recent Bureau of Public Roads recommendation that they insert a clause in contracts with engineering consultants designed to prevent "pirating" of departmental personnel, the Bureau reported this month. The federal agency does not frown on the practice of retaining consultants for federal-aid projects, but feared that private firms would deplete state highway department forces by offering better working conditions and higher salaries. Bureau officials pointed out that the federal-aid program is predicated on the assumption of strong state highway department engineering forces.

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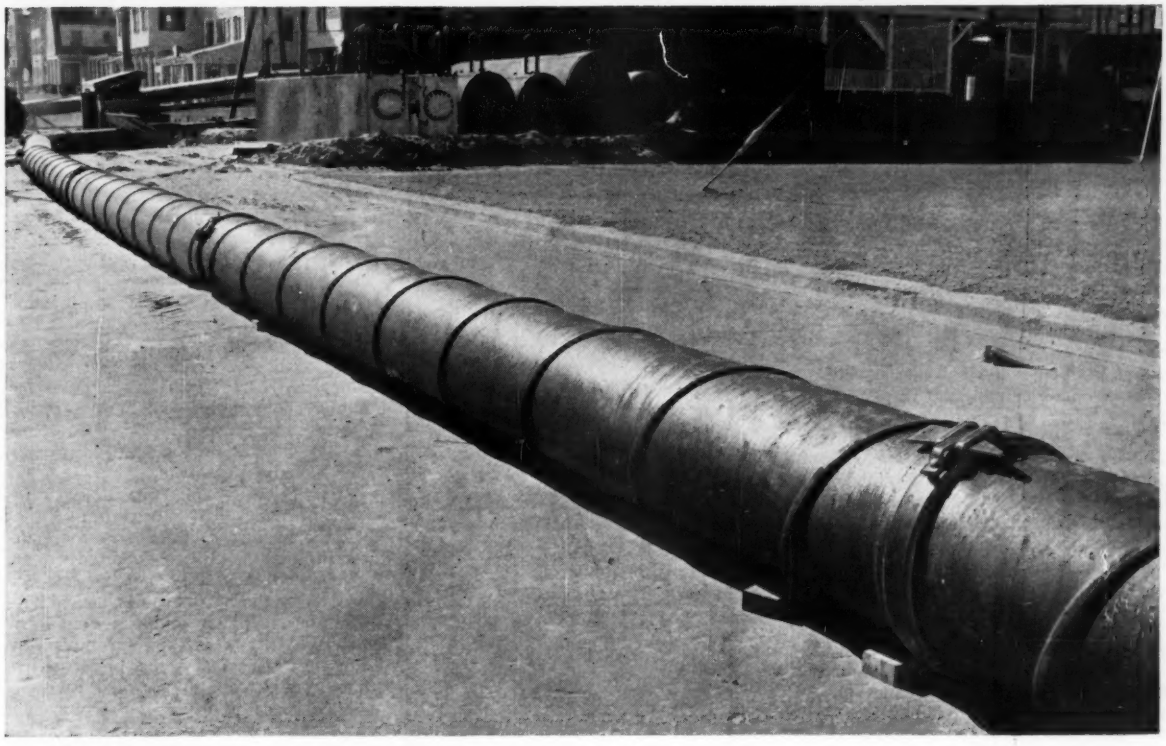

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NEWS BRIEFS . . .

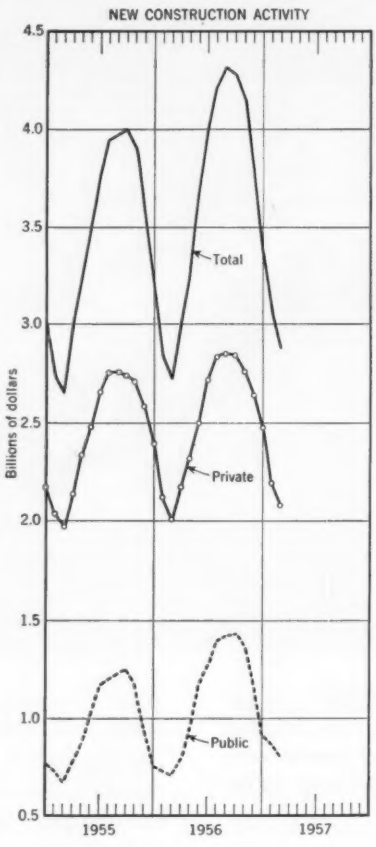
New Construction at Record February High

While new construction activity declined seasonally in February, the $2.9 billion of work put in place was slightly above the previous February record set in 1956, according to preliminary estimates of the U. S. Departments of Commerce and Labor. February outlays brought the total for the first two months of this year to almost $6 billion, an all-time high for the January-February period. On a seasonally adjusted basis, expenditures for new construction thus far in 1957 were at an annual rate of $44.7 billion, compared with the total of $44.3 billion actually put in place last year.

Private construction activity during January and February of this year was about the same (nearly $4.3 billion) as in the same period last year. Declines from 1956 in expenditures for new dwelling units and stores were offset by advances in virtually all other types of private construction. For the first two months of 1957 industrial plants, office buildings, churches, schools, hospitals, and public utilities were at record levels.

Outlays for new housing in January and February were $1.7 billion, off 8 percent from the corresponding 1956 figure. This was the second successive year in which the volume of new housing activity was below that for the first two-month period of the preceding year. In contrast, a 19 percent drop in store-building from January-February 1956 totals was the first such decline since 1952.

Again comparing the first two months of this year with last, public construction activity is up 11 percent, with all major categories sharing in the gain. The 1957 public total for January and February—not quite $1.7 billion—reflected record outlays for sewer and water facilities, schools, and highways.



Despite seasonal decline, new construction activity in February (at $2.9 billion) is slightly above previous February record set in 1956.

ASTM Committees Study Engineering Materials

A wide variety of engineering materials was studied by thirty-five technical committees of the American Society for Testing Materials during the organization's annual Committee Week, held in Philadelphia, February 4-8. Some 1,311 technical men did intensive work in 300 committee meetings, studying and correlating the tremendous amount of research upon which ASTM specifications and methods of test are based. Subjects covered in the new and revised tentatives and standards range from road and paving materials to wooden roof trusses for houses. These recommendations will be presented to the ASTM for adoption at its annual meeting, to be held in Atlantic City, June 16-21.

Among the many important subjects being studied by Committee D-4 on Road and Paving Materials are mechanical stability tests for designing bituminous mixtures, development of tests for the setting properties of bituminous materials, accelerated durability tests for bitumen, and the factors involved in the effects of water on bituminous-coated aggregates. The committee is also reviewing some of its time-honored tests to evaluate their effectiveness. Statistical methods are being used to analyze the cooperative test data. Prof. K. B. Woods, M. ASCE, of Purdue University, is chairman of Committee D-4.

Aggregates for masonry grout are covered in new specifications accepted by ASTM Committee C-12 on Mortars for Unit Masonry. The proposed specification includes both natural and manufactured sand used alone, or in combination with coarse aggregate, in grout for reinforced masonry. The present Specification for Mortar for Unit Masonry (C 370) is to be revised to avoid misuses that have been observed.

Committee D-7 on Wood reviewed the work of many of its subcommittees during the past year. Among the more interesting of the projects reported was an accelerated laboratory test method for evaluating the resistance of wood to natural decay, which is being considered together with a method for measuring the effectiveness of wood preservatives. The committee also accepted revisions in the basic principles for establishing grades of lumber, D 245. These revisions cover the stress grading of lumber for strength. L. J. Markwardt, M. ASCE, Forest Products Laboratory, Madison, Wis., is chairman of Committee D-7.

A new and extensive atmospheric corrosion program on non-ferrous metals and alloys is planned under the direction of ASTM Committee B-3. The program calls for the exposure of many of the newer alloys and some of the metals, which have recently become of commercial importance. It will provide mild and severe marine exposures and rural and industrial atmosphere exposures. Plans call for the removal of specimens at the end of two, seven, and on up to twenty years. Results of a recently completed eight-year program, showing the relative corrosivity of various exposure sites in North America, will be published in the near future.

Adoption of four new projects and a complete reorganization of its subcommittee structure featured a meeting of Committee E-6 on Methods of Testing Building Constructions. Work already done in testing methods for trusses (E 73) will be extended, as one of the new projects, into the field of testing wooden roof trusses which are widely used in house construction. Standard methods of test for vapor barriers under concrete slabs on the ground, as used for house foundations, will be developed. This project was adopted after consultation with

Committee C-16 on Thermal Insulating Materials. A new group will study a proposed method for making load tests on completed structures, standardization of which is urgently needed in building codes. The problem of testing windows will be tackled by a new subcommittee. It was unanimously agreed that there is urgent need for standard methods of test for these vital building components. R. F. Leggett, M. ASCE, of the National Research Council of Canada, is chairman of Committee E-6.

Thailand Dedicates Large Irrigation Dam

Thailand's new $58,000,000 irrigation and navigation dam on the Chao Phya River near Chainat (about 100 miles north of Bangkok) was officially dedicated by King Phumiphon in ceremonies held on February 7. By providing a controlled water supply for a rice-growing area the size of northern Ireland, the project will introduce double-cropping and add some 500,000 tons a year to the country's rice exports. It will also make possible year-round navigation on the Chao Phya River.

An $18,000,000 loan from the International Bank for Reconstruction and Development helped complete the project. Engineers with the U.N. Economic Commission for Asia and the Far East assisted with model tests, and Tippetts-Abbett-McCarthy-Stratton are the engineers on the project.

Precast Aluminum Convention Hall for Hawaii

Unique aluminum-domed auditorium, first of its kind ever built, is attracting attention on the grounds of the Hawaiian Village Hotel in Honolulu. Designed by Kaiser Aluminum and Chemical Corp., the dome is 49½ ft high, 145 ft in dia, and has a seating capacity of nearly 2,000. Its rigid aluminum shell, made of diamond-shaped panels geometrically arranged and bolted together, requires no interior support. Other major advantages include low cost, speed of erection (20 hours), and high strength. This newest convention facility in Honolulu will be of interest to engineers attending the Hawaii Section's all-day annual conference (page 81), to be held at the Hawaiian Village Hotel on May 15.

Group Set Up to Control Radioactive Waste Disposal

The Schenectady office of the Atomic Energy Commission and the New England states are cooperating in handling radioactive waste disposal in the New England area. At the suggestion of Jon D. Anderson, manager of the AEC's Schenectady Operations, the New England Interstate Water Pollution Control Commission has designated its Technical Advisory Board to serve in a liaison capacity with the Schenectady Office in matters relating to radioactive waste disposal that are of mutual concern.

Cooperation between the two groups is essential because of the increased amount of work being performed by New England industries under contract with the Schenectady Operations Office. The overall program for the prevention and control of water pollution emphasizes good plant design and operating procedures that limit the discharge of radioactive wastes so that only safe and permissible amounts are released to the environment.

The first such cooperative action took place in 1952 when the Schenectady Operations Office established the Mohawk River Advisory Committee to study the feasibility of discharging radioactive wastes into the Mohawk River. The present Technical Advisory Board is headed by William A. Healy, technical secretary of the New Hampshire Water Pollution Commission, Concord.

January Steel Output Sets Record for Month

Steel production in January, totaling 11,001,000 net tons, set a record for the month and marked the second time in history that monthly output reached the 11,000,000-ton mark, according to a preliminary report of the American Iron and Steel Institute.

At the January rate of production, the industry's steelmaking furnaces were only about three hours' operating time short of the record output of 11,048,513 net tons achieved in October 1956. The January 1957 output also compares with the December output of 10,837,545 net tons and production of 10,828,231 net tons in January 1956. According to preliminary figures, this output also represents 97.1 percent of the industry's operating capacity.

Huge Navy Drydock to Be Built in Boston

A contract for the design of an 1,160-ft drydock capable of handling the Navy's largest fighting ships, has been awarded the Boston engineering firm of Fay, Spofford & Thorndike, Inc., by Capt. Wesley H. Randig, district public works officer of the First Naval District. To be built on the site now occupied by Drydock No. 3 at the South Boston Navy Yard, the new dock will be the largest on the eastern seaboard and one of the three largest in the country. It is expected that plans for the $20,000,000 facility will be ready for bidding sometime in 1958.

Two other drydocks of similar size are planned, but they will be built along the West Coast—one at Bremerton, Wash., and the other at Mare Island, Calif.

New Rio Grande Bridge Utilizes Original Railing

Recently opened International Bridge over the Rio Grande between the United States and Mexico at Laredo, Tex., sports the same Alcoa aluminum railing that for 22 years graced the old bridge, which was washed away in the record 62½-ft flood of June 1954. The light weight of the railing made possible a type of installation that could be removed in 90 minutes in case of high water. It was thought that removing the railing would streamline the bridge and make it less resistant to surging flood waters. After surviving several floods, the bridge went down in the 1954 disaster, though not until city officials had safely removed its 1,720 ft of aluminum railing. The new bridge (described in the March 1956 issue, page 52) utilizes the old foundations, which were undamaged by the flood. Widening of the structure, on the old piers, to accommodate four traffic lanes was made possible by use of prestressed concrete for the superstructure.

West Coast Training Base for Air Force

The major portion of the Camp Cooke Military Reservation at Lampoc, Calif., has been transferred from U. S. Army to U. S. Air Force jurisdiction for use as a training base for Air Force missile units. Initial cost of the project, which will involve extensive rehabilitation, modernization, and new construction, is set at $25,000,000. Koebig & Koebig, consulting engineers of Los Angeles, Calif., have been named designers for the cantonment area, and the technical facilities will be designed by Holmes & Narver, Los Angeles architect-engineer firm.

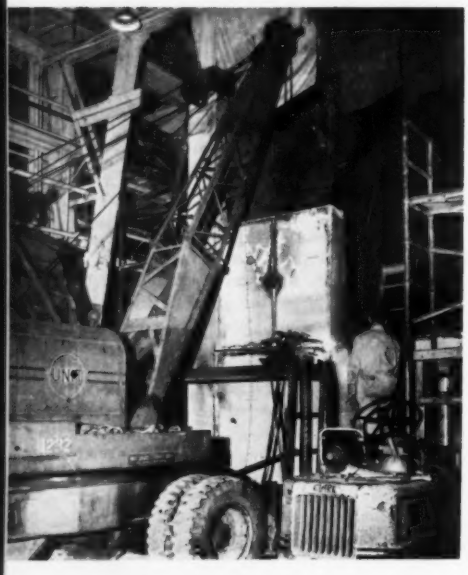
Col. Edwin M. Eads, Air Force Installations Representative, South Pacific Region, San Francisco, will supervise construction of the new facilities. Construction contracts will be let through the Los Angeles District of the Corps of Engineers, headed by Col. Arthur B. Frye. Contract advertising for some of the technical facilities and rehabilitation work is scheduled to begin this spring.

Fewer Dwelling Units Started Last Year

Construction was started on 1,120,200 houses and apartments in nonfarm areas of the country in 1956—the eighth successive year in which housing starts passed the million mark—the U. S. Department of Labor's Bureau of Labor Statistics reports. This total was down 16 percent from 1955 and 8 percent from 1954, but was about the same as annual totals in the 1951-1953 period. When allowance is made for population growth, however, the 1956 rate of homebuilding (new nonfarm dwelling units per 10,000 nonfarm population) was the lowest since the early postwar years.

Almost all the decrease from 1955 occurred in metropolitan areas, and in units started under FHA and VA programs, which tend to be concentrated in metropolitan suburbs. In general, however, the distribution of new housing among the four broad geographic regions remained about the same. As in 1955, nearly 90 percent of all new housing last year consisted of one-family houses.

More public housing was started in 1956 than in the previous two years, but the 1956 total of 23,400 public units was less than half the annual average for the 1949-1953 period. The increase over 1955 was chiefly in federally owned housing at military bases on projects popularly referred to as Capehart housing (authorized in the Housing Amendments of 1955).



Blow Pipe Tool Speeds Concrete Cutting

Rectangular structure of reinforced concrete in a factory at Tonawanda, N. Y., is flame cut for removal. Blow pipe cutting tool and method are development of Linde Air Products. Cutting average is 1½ in. per min for heavily reinforced concrete ranging from 10 to 24 in. thick. Process uses a 70 percent iron powder, 30 percent atomized aluminum powder mixture flowing at the rate of 15 oz per min with oxygen flowing at the rate of 3,000 cu ft per hour. Method permitted factory operation to continue without interruption.

Chicago to Test New Sewage Disposal Method

Research aimed at more economical methods of disposing of sewage solids—by use of the Zimmermann Process—will be undertaken jointly by the Chicago Sanitary District and Sterling Drug Inc. Headquarters of the cooperative field project will be the Sanitary District's Southwest Treatment Works, key plant in the disposal system cited in 1955 as one of the "Seven Wonders of American Engineering."

The Zimmermann Process, which was developed by Sterling engineers, holds promise of reducing the cost of one of the most expensive steps in the treatment and disposal of sewage solids. According to William A. Dundas, general superintendent of the Sanitary District, the end products of the process after the "simple wet combustion are water with an acceptable chemical oxygen demand, and a small amount of non-offensive ash." Under the present methods used by the District, the sewage solids are separated from the water in a series of steps, including the addition of chemicals, filtration and heat drying. The end product is a commercial fertilizer.

The new research contract calls for the Sterling firm to assume all costs of constructing a pilot plant and installing equipment, and to furnish supervisory and technical personnel to operate the plant. In this test plant engineers will evaluate the cost of "burning" sewage sludge in various concentrations of from 2 to 6 percent or more.

The Chicago Sanitary District serves 104 cities and villages in an area of over 900 sq miles, with a population of over 5,000,000, and an additional industrial sewage load equivalent to 3,500,000 persons.

AWWA Safety Awards Honor Wendell Ladue

A series of annual safety awards has been set up by the American Water Works Association and named in honor of Wendell R. LaDue, M. ASCE, superintendent and chief engineer of the Akron (Ohio) Bureau of Water Supply. By encouraging safety practices in public water utilities throughout the country, the new awards will advance a program initiated a year ago with development of the AWWA Safety Practices Manual. The award plan is divided into two parts—one recognizing improved safety practices within the association's regional sections, and the other giving association-wide recognition for safety achievements.

The headquarters of the AWWA is at 2 Park Avenue, New York 16, N. Y.

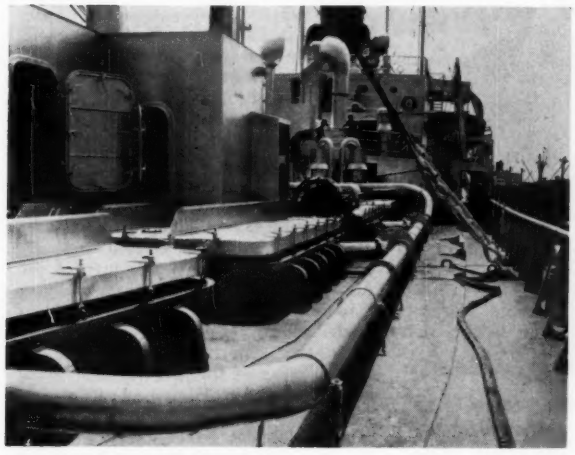
Skyscraper Center Planned for Manhattan

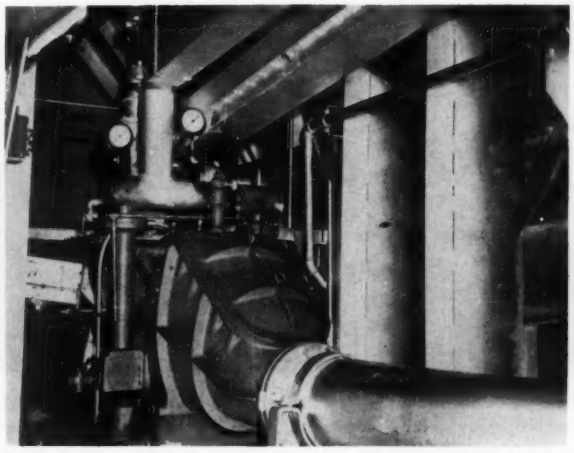
Another huge multi-unit skyscraper center is being planned for a three-square-block area in midtown Manhattan by the Alfred I. Du Pont Estate of Florida. Covering the entire area bounded by Park and Lexington Avenues and East 46th and 49th Streets, the project is expected to dwarf in size and scope all office building centers created in New York City since the Rockefeller Center group was built a generation ago and to cost well in excess of $100,000,000. It will consist of five buildings, providing a total of 5,000,000 sq ft of office and retail space.

The buildings which will be of modern slab tower design, with large landscaped garden areas along most of the Park and Lexington Avenue frontages, will include a main structure at least 30 stories high flanked by two 20-story structures on the block to the north and two of similar height on the block to the south. They will feature modern curtain wall construction and large window areas.

A major feature of the proposed center will be a direct entrance from the buildings to the platforms of the New York Central and New Haven Railroads under Park Avenue so that commuters will not have to pass through Grand Central Terminal.

Cement Ship Handles Bulk Cargo Pneumatically



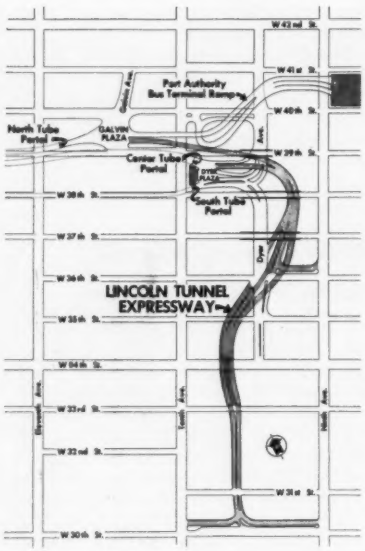


This converted Liberty ship—the S. S. Florida, owned by Ponce Products, Inc.—is said to be the first vessel to handle the unloading of bulk cement entirely by air. After conversion at the Todd Shipyards, the vessel is now in service hauling cement from Ponce, Puerto Rico, to Port Everglades, Fla. To convert it, Theodore E. Ferris & Sons, naval architects, installed open-type Fuller-Huron Airslides to form the bottom of the cement compartments; four Fuller-Kinyon pumps to receive the cement from the Airslides and convey it (through 10-in. transport lines) to on-shore storage silos; and eight rotary compressors to supply compressed air for the pumping operation. Unloading equipment was designed and built by Fuller Co., Catasauqua, Pa. Ship's total capacity of 55,000 barrels of cement can be loaded or unloaded in 16 hours. Right-hand photo shows one of the pumps, all of which are operated by push-button control. At upper right is Airslides crossover, which conveys the cement from the bulk compartment to the pumper hopper.

Lincoln Tunnel Expressway to Expedite N. Y. Traffic

The $11,000,000 two-way Lincoln Tunnel Expressway, extending between the Lincoln Tunnel and West 30th Street, Manhattan, was opened to traffic on February 19 in ceremonies headed by Mayor Robert Wagner. Expressway connections with downtown streets at 36th, 33rd, 31st, and 30th Streets will expedite traffic between the tunnel and midtown and downtown Manhattan. The project includes a 470-ft steel-girder bridge across the Pennsylvania Railroad yards between 31st and 33rd Streets.

The eight-block-long, four-lane Expressway is part of the Port of New York Authority's $100,000,000 Lincoln Tunnel Third Tube Project, which will open later this spring.



Directional signs that can be mechanically rotated and operated by remote control will route Expressway traffic when three-tube operation of the tunnel commences. The direction of traffic in the center tube can be reversed as traffic demands.

Versatile Machine Pushes Work on Memphis Power Plant

This powerful machine—an International TD-24 crawler tractor, with "sideboards" welded onto the blade to boost pushing capacity—makes molehills out of mountains in earthmoving work on the new Memphis, Tenn., steam electric generating plant project. The unit, which is owned by Jumon and Rogers, Memphis, shoves material a distance of 300 ft into the fill, moving an average of 200 cu yd an hour. A dragline eases the task by supplying dirt from a 30-ft pile. The fill, which will use 250,000 cu yd of material, is one of three required for the groundwork of the new plant. To provide a suitable foundation for the base of the main plant, it was necessary to go down about 40 ft to suitable foundation. Steel casings measuring 70 and 80 ft were sunk and will be filled with concrete for pilings. The plant, started in September 1956 and due for completion in late 1958, will cost an estimated $154,000,000.

High Rate of Water Use in Delaware Basin

Water in the Delaware River Basin is being withdrawn for public and industrial uses at more than five times the national rate per square mile, according to a recent report released by Secretary of the Interior Fred A. Seaton. In 1955 some 6,000 mgd was taken from streams and wells in the basin. More than 90 percent of this amount—the equivalent of nearly half a million gallons per day per square mile—was from surface sources, such as streams, lakes, and reservoirs. Nearly three-quarters of it was withdrawn from the southern one-third of the basin, which includes the cities of Philadelphia, Trenton, Wilmington, and Camden. Water use from all sources was equivalent to nearly 1,000 gal per day per person.

The report—prepared by the Geological Survey and written by J. C. Kammerer—includes an evaluation of data gathered during more than fifty years of cooperative water-resources investigation by the Geological Survey and state, municipal, and federal agencies. Copies may be obtained from the Geological Survey offices in Philadelphia or Washington, or from G. G. Parker (67 Long Lane, Upper Darby, Pa.), who is in charge of the Delaware Basin Project for the Survey.

AWWA Chooses New Officers

New officers of the American Water Works Association are Fred Merryfield, M. ASCE, professor of sanitary engineering at Oregon State College, president; Lewis S. Finch, M. ASCE, vice-president and chief engineer of the Indianapolis Water Company, vice-president; and William J. Orchard, director of Wallace & Tiernan, treasurer. Harry E. Jordan, M. ASCE, continues as secretary. William W. Brush, M. ASCE, has been elected treasurer emeritus. He has been treasurer of the AWWA since 1922, except for a two-year period as vice-president and president of the association.

The new slate, nominated at the annual meeting of the AWWA board held in New York in January, has automatically been elected.

New elections to honorary membership are Albert E. Berry, director of sanitary engineering in the Ontario Department of Health; Charles H. Capen, M. ASCE, consulting engineer and retired chief engineer of the North Jersey District Water Supply Commission; S. Logan Kerr, M. ASCE, consulting engineer of Flourtown, Pa.; and W. A. Kunigk, retired superintendent and chief engineer of the Tacoma (Wash.) Water Division.

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Fifty Years of Engineering Registration

WILMA LANG

Assistant Secretary, Wyoming State Board of Examining Engineers

BLACKSMITH & CIVIL ENGINEER read the letterhead of an enterprising citizen of central Wyoming fifty years ago. Note that the blacksmithing trade carried financial precedence over the engineering profession and when, in 1907, the Wyoming Legislature created the first law in America requiring qualification and registration of civil engineers, his professional services were terminated and the letterhead was reprinted to read **BLACKSMITH.**

Those were the days when a man who owned a four-rod Gunter's chain, compass with Jacob's staff, and a farm level purchased from a mail order catalog, considered he had all the necessary equipment to advertise his services as a civil engineer. Many of the surveyors hired by the rapidly increasing populace of the new State of Wyoming did not know how to set up an engineer's level. The unsuspecting public knew little of their qualifications.

To Clarence T. Johnston, (M. ASCE since 1904) then state engineer charged with the responsibilities of adjudication and administration of all waters of Wyoming, it appeared anyone could deface a piece of tracing cloth and send it to his office as a proper map for filing an application to appropriate water. Determined to put an end to maps—often not based on surveys yet sworn to as correct, and drawn on paper sacks, wallpaper, or whatever was within easy reach of the so-called engineer—the state engineer sought legal remedy.

At that time there were only a few members of the American Society of Civil Engineers in practice in Wyoming. Mr. Johnston, in consultation with Edward Gillette and William Newbrough, practicing engineers, prepared a bill for the legislature. This bill was not patterned after any previous license law. The proposed legislation met with little opposition, and on February 20 was enacted as Chapter 86, Session Laws of Wyoming, 1907.

The Board of Examining Engineers, consisting of the state engineer and two other engineers appointed by the Governor to serve without compensation, lost no time in holding examinations in nearly every county seat in Wyoming. Within two years 134 were registered in the following classes:

First—**Land Surveyor** (Examination in plane surveying) authorized to lay out irrigation works for the reclamation of not more than one thousand acres of land, or design a reservoir where the depth of water stored was not greater than ten feet.

Second—**Topographic Engineer** (Examination in plane and topographic surveying) authorized to survey rights-of-way in addition to work in the first class.

Third—**Hydraulic and Topographic Engineer** (Examination in plane surveying and hydraulics) authorized, in addition to work in the first two classes, to do hydraulic work not in excess of $7,500 and measure streams and ditches.

Fourth—**Construction and Designing Engineer** (Examination in plane surveying, irrigation works and structures and computation of earth work).

Fifth—**Administrative Irrigation Engineer** (Examination on work included in the first four classes, plus a knowledge of irrigation law and court decisions pertaining thereto).

The law required that the Board examine the moral character of every applicant and provided that a license be refused to anyone who was incompetent, dishonest, intemperate, or addicted to any habit that would render him an unsafe employee. Any registrant found incapable of carrying on the class of work for which he was licensed, or who became morally unfit to practice, was subject to disqualification and revocation of his license. The state engineer was directed to refuse to accept all work of those who did not become registered.

The first engineering and surveying registration law was enacted in an era of reclamation expansion and irrigation development in the West. In his report to the Governor in 1910 concerning the Board of Examining Engineers' activities, the state engineer wrote: "This board meets as often as possible and it conducts examinations every week . . . This law has received unanimous approval from all who have studied it, because it is brief and leads to the result that should always be sought. There is no reason why an important profession such as an engineer practices should not be recognized by the law, or why every member of that profession should not be held responsible for his work when such work is always of some concern to the public . . . Every state will ultimately follow the lead of Wyoming in this important matter . . . With the growth of the state the importance of the engineer must be fully recognized, and it is extremely fortunate that our lawmakers provided a statute of this kind at a time when most of the important development is still before us." Little did he imagine it would be forty years later before Wyoming's sister state of Montana would pass an engineering registration law!

At the end of ten years nearly three hundred licenses were issued in the five classifications. As young engineers gained experience, they applied for examinations in higher grades, until registration was finally achieved in all classes. While the need for accurate surveys and engineering data in the field of irrigation spurred development of a license law, ten years of administration by the Board of Examining Engineers proved its scope must be broadened to include other fields of endeavor.

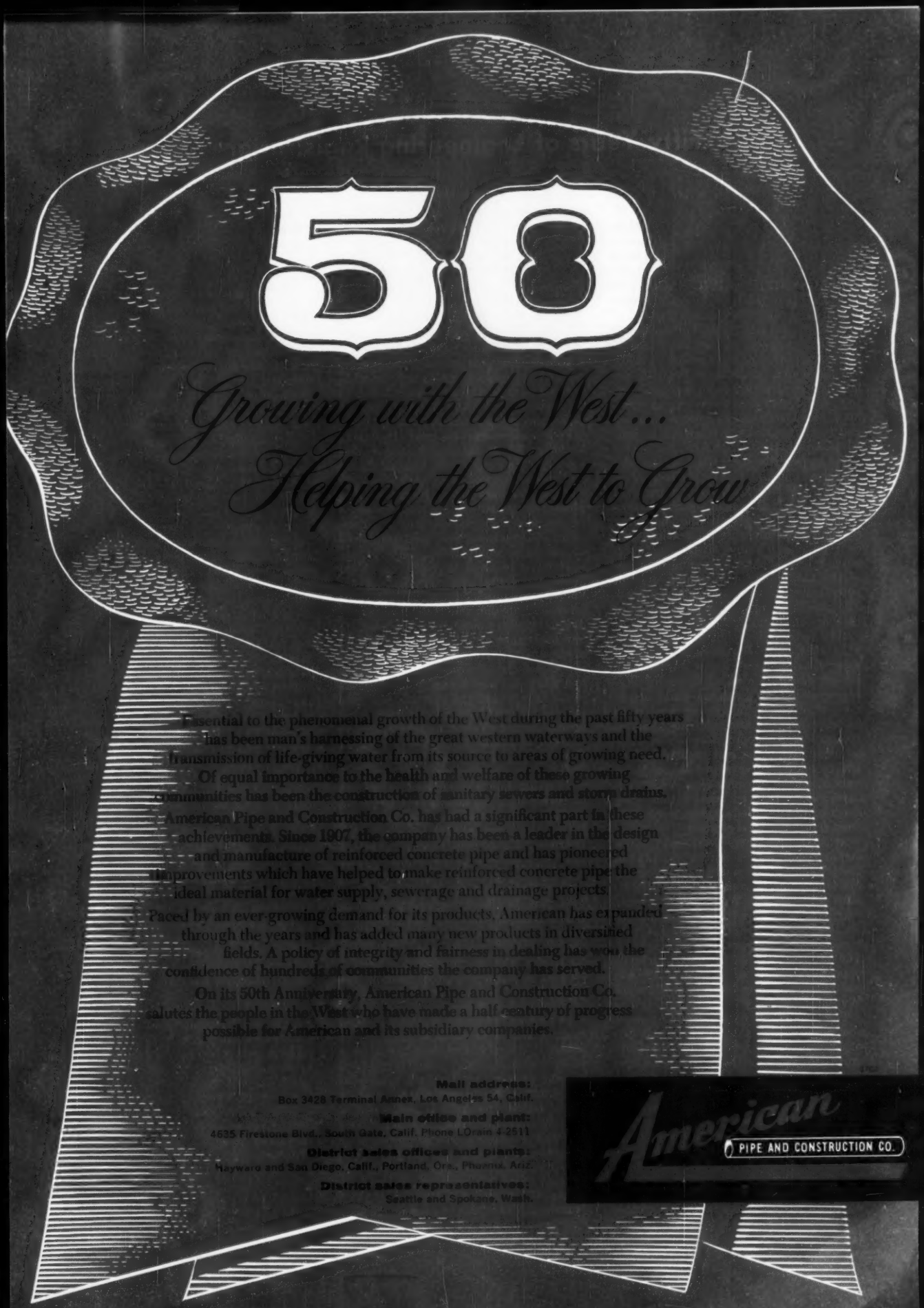
Accordingly, in 1917 and again in 1919, the law was amended to require registration of all those engaged in the general practice of engineering or surveying in connection with municipal work, survey of property lines, or subdivision of lands. The 1917 statute specified that all surveying or engineering work done by or under the authority of any village, town, city, county or political subdivision, or the state, must be performed by a licensed engineer. Registered engineers were authorized to administer and certify oaths for applications for use of water, or for establishing old or lost corners or perpetuating those in perishable condition, when the importance of the survey made it desirable, or for faithful preformance of duty, using an impression seal prescribed by the Board. A surety bond of $500 was mandatory, and the license was in force only as long as the surety bond was in effect.

Five classes of registration were found unwieldy and in 1917 were narrowed to:

Surveyor (formerly first three grades)
Junior Engineer (previously fourth grade)
Senior Engineer (formerly fifth grade)

A revision in 1919 provided simply for "Engineers" or "Surveyors." In 1925 the present-day classifications of Professional Engineer, Land Surveyor, or Professional Engineer and Land Surveyor were established. This Act also contained the current provision that a registered professional engineer is not authorized to make land surveys. The amendment necessitated issuance of new license numbers and cancellation of surety bonds, which were found impractical.

With the decrease in promotion of reclamation projects, there were fewer practicing engineers and surveyors in Wyoming, and when the new numbers were issued in 1925 it was found no more were registered than at the end of the first two years. However, two amendments in 1925 prompted a gradual increase in registration. The first of these



Essential to the phenomenal growth of the West during the past fifty years has been man's harnessing of the great western waterways and the transmission of life-giving water from its source to areas of growing need. Of equal importance to the health and welfare of these growing communities has been the construction of sanitary sewers and storm drains. American Pipe and Construction Co. has had a significant part in these achievements. Since 1907, the company has been a leader in the design and manufacture of reinforced concrete pipe and has pioneered improvements which have helped to make reinforced concrete pipe the ideal material for water supply, sewerage and drainage projects.

Paced by an ever-growing demand for its products, American has expanded through the years and has added many new products in diversified fields. A policy of integrity and fairness in dealing has won the confidence of hundreds of communities the company has served.

On its 50th Anniversary, American Pipe and Construction Co. salutes the people in the West who have made a half century of progress possible for American and its subsidiary companies.

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required all maps, plats or designs filed in offices of public record must be made and certified to by a registered engineer or land surveyor. The second gave authorization for issuance of reciprocal licenses to registrants of other states meeting Wyoming's statutory requirements as to character, education and experience.

Except for a decrease in biennial renewal fees during World War II, the law remained unchanged for the next thirty years. In 1955 a provision was added to permit Engineer-in-Training status and fees were increased to cover operational expenses.

After fifty years, the Board of Examining Engineers still endeavors to fulfill the aim of the first Board, "to be as helpful as possible" to the 712 professional engineers and surveyors now licensed to practice in Wyoming. Of course, examinations are no longer given every week; just in March and November, and since 1925 all applicants have been required to show a background of experience and education, or in lieu of a degree in engineering four years of experience. The three members of the Board are still serving without compensation, even though by law they may be paid. In May the membership of the Board will be increased from three to five, under an amendment passed by the 1957 Legislature.

In commemoration of the Golden Anniversary of the registration law, and in tribute to its author, Clarence T. Johnston (now residing in Ann Arbor, Mich.) the Wyoming Engineering Society, at its convention on March 16, issued honorary memberships and certificates, appropriately lettered in gold, to each of the remaining sixteen registrants, saluting them on their "fiftieth anniversary as one of the first hundred licensed engineers in America." They were similarly honored with memberships in the Wyoming Association of Practicing Engineers and Surveyors. Original License No. 86, issued September 24, 1907, was displayed at the convention by its holder, L. C. Bishop, M. ASCE, state engineer and secretary of the State Board of Examining Engineers.

In the words of the Wyoming law: "In order to safeguard life, health and property, any person practicing or offering to practice professional engineering or land surveying" in this, or any other state, must today be registered, which accounts for 227,000 qualified professional engineers and land surveyors licensed in the United States.

Midwest Utility Group Plans New-Type of Atomic Plant

Construction of a full-scale atomic power plant of advanced design will be undertaken by a group of Midwest electric utilities. The Pioneer Service and Engineering Co., of Chicago, which has participated in developing the project, will be the architect-engineer. Present plans call for a 60,000-kw plant to be completed by 1962. The cost will be between $20,000,000 and $25,000,000.

With the approval of the Atomic Energy Commission, the plant will be located on an as yet undesignated site on the system of the Northern States Power Co., which would own and operate the plant. This system was chosen because of its size and the extent of its transmission system. Major interconnections between companies will permit energy produced by the atomic power plant to flow into the systems of the ten participating companies.

The joint utility group is negotiating with the Allis-Chalmers Manufacturing Co., of Milwaukee, Wis., which has been studying a recirculation boiling water reactor, to act as prime contractor. This type of reactor represents a forward step in developing the boiling water reactor, and it is believed that it will be a significant contribution toward making atomic power competitive with conventional power.

N. G. Neare's * COLUMN

R. ROBINSON ROWE, M. ASCE

"Guest Professor Joe Kerr! What do you think of your new title and what kind of a time did you have at the Jackson Convention?"

"Wonderful, Professor Neare, and wonderful to both questions."

"Then start guest-professing. We'll reminisce about Jackson later."

"All I have to do is call on Cal. Fig. 1 shows my 12-wire prismatic network of resistance wires and the potentials at 6 vertices and I asked for the potential at A. It looks like an easy shunt-circuit problem, but there are actually six 3-wire interconnected circuits so that you get 18 equations in only 5 unknowns. How did you solve them, Cal?"

"Didn't have to," boasted Cal Klater. "I used 3 equations in 3 unknowns."

"That I must see," scoffed Joe.

"Then start looking at the symmetry of the potentials. Those on any two opposite vertices add to 15 volts, so if the potential at A is x, that at B is $15-x$."

"One unknown so far," counted Joe.

"Then look at the 3 sets of 4 equal wires. Let the conductances in mhos be c for those parallel to the Y-axis, uc for those parallel to the Z-axis, and vc for those parallel to the X-axis."

"Two, three, *four*," counted Joe.

"Keep looking. The current in any wire is the potential drop times the conductance and the currents to and from any vertex have to balance. Writing current equations at the 6 intermediate vertices duplicates these 3:

$$c\,(x-10) = 3uc + 4vc \quad \ldots\ldots (1)$$

$$uc\,(x-9) = 2c + 4vc \quad \ldots\ldots (2)$$

$$vc\,(x-8) = 2c + 3uc \quad \ldots\ldots (3)$$

"C, u, v, and x make 4," persisted Joe.

"Now look while I cancel out all the c's and . . ."

"Lucky you!"

". . . and eliminate u and v to find the cubic

$$x^3 - 27x^2 + 216x = 528 \quad \ldots\ldots (4)$$

which can be solved by Horner's method to find $x = 14.846672$ volts."

"Right for 64 cents and a can of Simpson's Slipstick Solvent," cried the Professor. "If this answer appears awkward, it can be explained that the terminal at A was a short piece of the same wire, with a counterpart at B, so that A could be 15 volts and B was grounded. Equation (4) has two other solutions $x = 7.244$ and 4.909), but each involves negative conductance which is one of the undiscovered secrets of perpetual motion.

"Have you ever heard of Seymour V. Hickels, the traffic engineer who works as he goes to work? His Jagwagon Convertible is equipped with an optical counter that registers every car passed or passing in either direction, and is so narrow that Seymour can maintain any desired speed by weaving in traffic or riding the shoulder or median. This commuter traffic is steady each way, but slower and denser inbound.

"Last Friday he ran 5 min at 40 mph and counted 198 cars, then 6 min at 48 mph to count 220, than 6 min at 60 mph to count 251, and finally 6 min at 70 mph to count 311. How many cars were going how fast each way?"

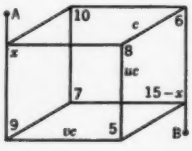
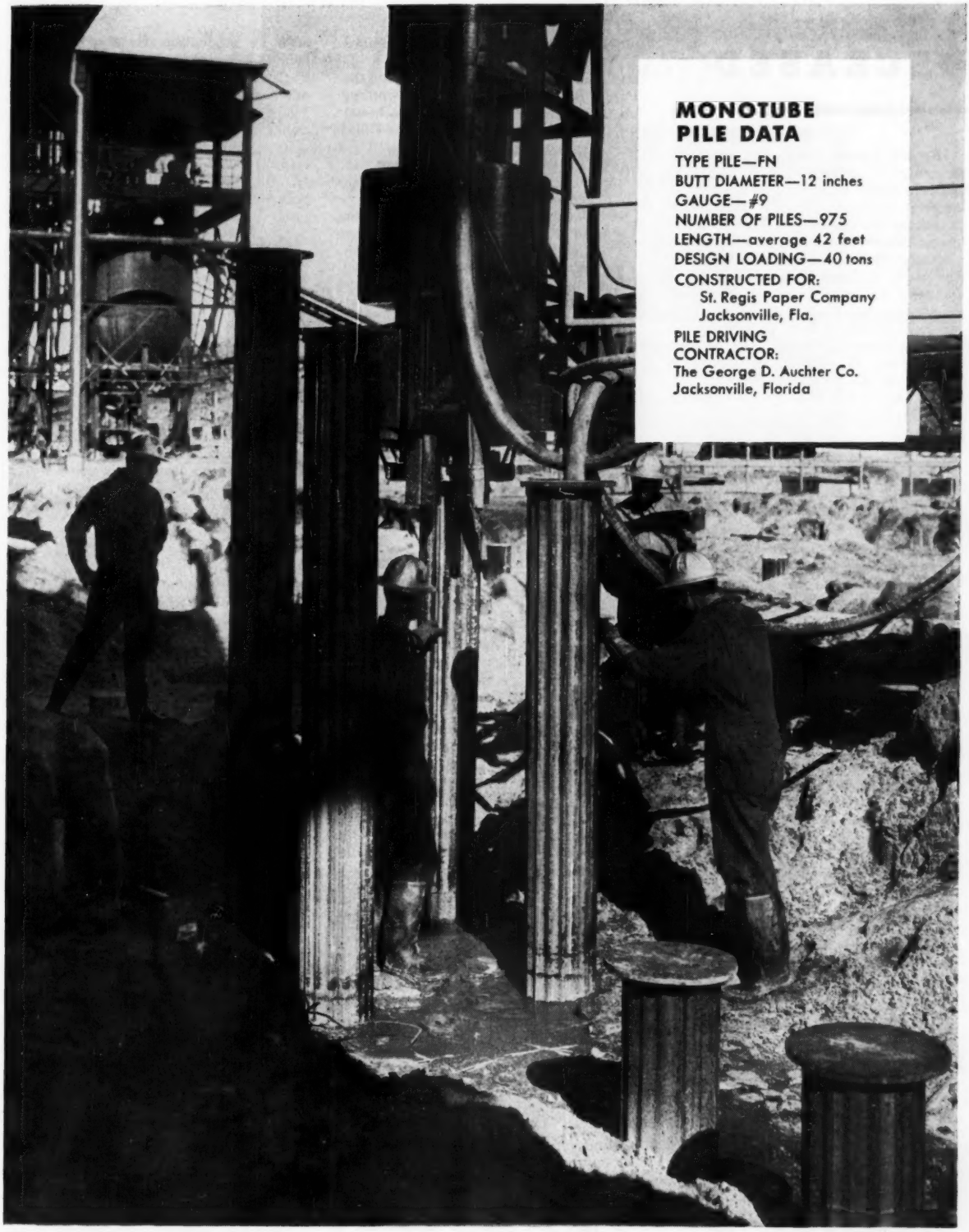


Fig. 1. Cal Klater used conductances, C, UC, and VC to unravel Joe Kerr's analog network.

[Cal Klaters were Henry W. Troelsch, Sauer Doe (Marvin Larson), and Theodore Kreiberg. Cal Klaters for the problem solved in the March issue (received too late for inclusion) were: Sauer Doe, R. E. Philleo, Thatchrite (Guy C. Thatcher), H. Francis Finch, and Julian Hinds.



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DECEASED

Howard Carter Baird (M. '04), age 88, retired consulting engineer and specialist in bridge building, died recently at his home in Chicago, Ill. Mr. Baird had a consulting practice in New York City for almost thirty years—from 1912 to 1923 as a member of the firm of Boller & Hodge. The many projects with which he was identified include the Bear Mountain Bridge over the Hudson River, the Croton Lake Bridge in New York State, the St. Louis Municipal Bridge over the Mississippi, and the Rio Chico Bridge in Mexico. At the outset of his career Mr. Baird was with the Phoenix Bridge Company for fourteen years.

George Heckman Burgess (M. '09), age 83, a partner in the firm of Coverdale & Colpitts, consulting engineers of New York City, died there on March 1. Mr. Burgess was a civil engineering graduate of the University of Wisconsin in 1895. He became associated with Coverdale & Colpitts in 1925 and was made a partner in the firm three years later. Earlier in his career he was president of the Burgess Battery Co. and the Tennessee, Alabama & Georgia Railway Co.

Thomas Hays Campbell (M. '54), age 70, retired superintendent of construction in the Seattle office of the Stone & Webster Engineering Corp., died at his home in El Verano, Calif., on January 23. Beginning his career with Stone & Webster in 1923 as a field engineer, Mr. Campbell designed and built many transmission lines and other installations in the utilities field. He later held the positions of resident engineer and job superintendent, and from 1930 until his retirement was superintendent of construction.

John H. Chase (M. '39), age 62, for the past ten years director of the Sanitary Division of the 11th Naval District at San Diego, died recently at his home in La Jolla, Calif. Mr. Chase was a graduate of Massachusetts Institute of Technology, class of 1918, and also held B.S. degrees from Harvard and the University of Rochester. A specialist in gas and diesel power applications, Mr. Chase had a consulting practice at Riverside, Calif., for a number of years. Earlier (1926 to 1930) he was an engineer for the Riverside Highland Water Co., and prior to that (1922 to 1926) assistant engineer and superintendent for the Sante Fe Irrigation District at Del Mar, Calif.

Charles Henry Dading (M. '41), age 73, retired civil engineer of Bala-Cynwyd, Pa., died recently in a Philadelphia hospital. For seven years prior to his retirement in 1954 Mr. Dading was a civil engineer for the Federal Housing Administration in Philadelphia. For a number of years Mr. Dading maintained a consulting practice in Camden, N. J., and from 1931 to 1940 he was with the Public Building Administration, working on the Philadelphia, Camden, Rochester (N. Y.) and other important Post Office buildings. He was a graduate of the University of Pennsylvania, class of 1906.

Ralph B. Daudt (M. '32), age 68, retired engineer of Toledo, Ohio, died recently at his home at LaSalle, Mich. From 1909 until his retirement in 1950, Mr. Daudt was with A. Bentley & Sons Co., of Toledo, which he served in various capacities. He was appointed vice-president in 1922 and executive vice-president and director in 1942. Numerous projects in the Midwest and Florida, built under his supervision, included bridges, office buildings, ordnance depots, schools and factories. Mr. Daudt held both A.B. and C.E. degrees from Cornell.

Frank E. Davis (M. '49), age 57, for the past eight years partner in the consulting firm of Davis & Holman, Stockton, Calif., died there recently. A 1921 graduate of the Colorado A. & M. College, Mr. Davis spent six years as irrigation engineer in the Division of Irrigation and Practice at the University of California. From 1928 to 1931 he was chief engineer for the Woodbridge Irrigation District. Later he was in private practice in Stockton being retained as chief engineer for the Woodbridge Irrigation District, the Dos Palos Drainage District, and the Linden Irrigation District. From 1942 to 1944 he was an engineer for Bethlehem-Alameda Shipyard, Inc., on the construction of four reinforced concrete shipways, and from 1944 to 1948 was district engineer and senior construction engineer for the FWA in charge of the War Public Work Construction Program in Northern California.

A. D. Edmonston (M. '44), age 70, former state engineer of California, died in San Francisco, Calif., on February 22. Mr. Edmonston was one of the original collaborators on the Central Valley Project and planned the proposed Feather River Project, the largest single water and power plan ever devised, which is now pending before the State Legislature. Mr. Edmonston entered state service in 1924 after a brief career in private industry. He became principal hydraulic engineer and deputy state engineer in charge of water investigations and other activities of the Division of Water Resources, and acting secretary of the state's Water Project Authority. In 1945 he was made assistant state engineer and in 1950 state engineer. He retired in 1955.

Olaf John S. Ellingson (A.M. '12), age 72, retired engineer of Houston, Tex., died at his home there recently. A graduate of the University of Texas, Mr. Ellingson was an instructor in charge of the School of Drawing there for several years after his graduation. He had been city engineer and city manager of Sherman, Tex., and city manager of Brownsville and San Antonio, Tex., and of Key West, Fla. From 1932 to 1942 he was with the Texas Prison System at Huntsville, as general manager in charge of construction. He was also manager of distribution for the War Production Board at San Antonio during the war years.

Cornelius E. Elmendorf (M. '25), age 72, retired consulting engineer, died recently at his home in Irondequoit, N. Y. He was president of the William S. Lozier Co., a consulting firm in Rochester, N. Y., specializing in sanitary engineering. A graduate of Union College, Mr. Elmendorf supervised the enlargement of sections of the New York Barge Canal and construction of the Barge Canal Terminal. He also supervised construction of Letter Kenny Ordnance Depot in Pennsylvania during World War II. He designed many of the water works and sewage systems in western New York.

Harry B. Floyd (A.M. '27), age 63, engineer with the Union Paving Company of Philadelphia, Pa., died at his home there recently. Mr. Floyd became connected with Union Paving in 1921 as assistant engineer and had served the company for more than 35 years. Earlier he was associated with the Pennsylvania Railroad in various capacities. Mr. Floyd was a World War I veteran.

Harold J. F. Gourley (M. '25), age 69, senior partner in the engineering firm of Binnie, Deacon and Gourley, London, England, died in that city recently. A 1910 engineering graduate of the University of Liverpool, Mr. Gourley received his master's degree there in 1912. Shortly after graduation he joined the engineering firm of Sir Alex Binnie, Son & Deacon as assistant engineer. Later he was appointed chief engineer and in 1923 became a member of the firm. Mr. Gourley spent his entire career with the firm with the exception of four years service as a major in the Royal Engineers in World War I.

Frederick W. Henrici (M. '19), age 77, former manager of erection for the American Bridge Co. in Pittsburgh, Pa., died recently in Evanston, Ill. A graduate of the University of Pittsburgh, class of 1905, Mr. Henrici worked for two years as assistant engineer with Westinghouse Church, Kerr & Co. at Frederick, Md. In 1907 he began a 38-year career with the American Bridge Co. He was appointed assistant to the general manager in 1926 and held the position of manager from 1938 until his retirement in 1945. Mr. Henrici served in World War I as a major in the Corps of Engineers.

Paul Davis Hertzler (J.M. '52), age 30, for the past two years, highway engi-

(Continued on page 102)

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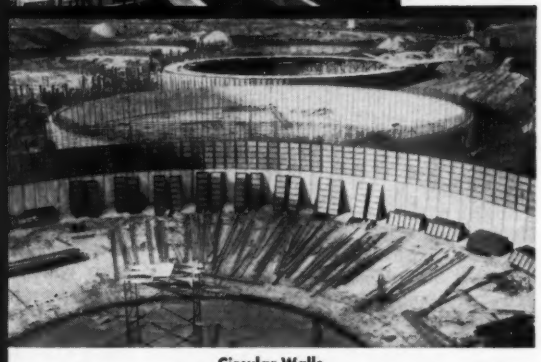
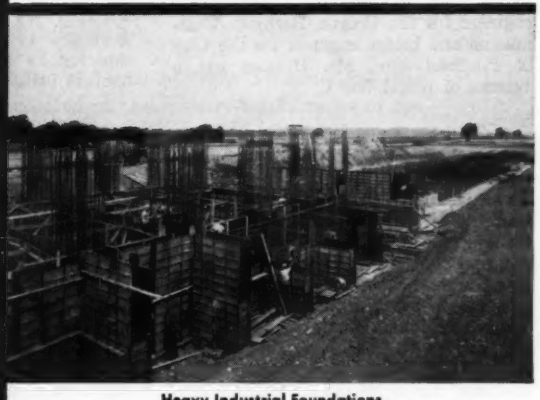


Circular Walls

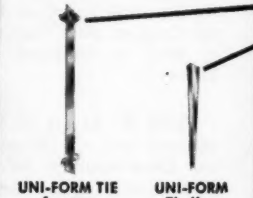


Heavy Industrial Foundations

Whether you're bidding on a sewage treatment plant, industrial building, highway bridges, overpasses or abutments, heavy foundations, circular tanks or a warehouse, UNI-FORM Panels will give you the lowest all around forming costs.

Why? UNI-FORM Panels can be erected faster, using less labor and material because the three basic elements of the UNI-FORM System—Panel, Tie and Tie Key provide simple mechanical assembly into any type of form. Unique system of attaching the minimum aligning lumber required reduces labor by 50% . . . pre-engineered techniques for handling pilasters, corners, stepped footings, columns, battered walls assure fast job progress.

Steel framed, plywood faced UNI-FORM Panel



UNI-FORM TIE for any wall width

UNI-FORM Tie Key

3 simple elements in UNI-FORM SYSTEM

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ATLANTA, GEORGIA 1401 Howell Mill Rd., N.W. TRinity 6-8126

Deceased

(Continued from page 100)

neer trainee with the Virginia Department at Louisa, Va., died there recently. A graduate of Goshen (Ind.) College, class of 1948, Mr. Hertzler received his civil engineering degree from Purdue University in 1952. Shortly after graduation he became a junior design engineer with the firm of Alfred Benesch & Associates, structural design engineers of Chicago, leaving to join the Virginia Department of Highways in 1954.

Bancroft Hill (M. '42), age 69, consulting engineer of Baltimore, Md., died at his home there on January 5. Mr. Hill was educated at Johns Hopkins University and Massachusetts Institute of Technology, where he majored in railroad engineering. In 1915 he was appointed president and chief engineer of the Artesian Water Co., of Baltimore, a forerunner of the city's water system, and four years later was made harbor engineer for the city. In 1924 he joined the Baltimore Transit Co., rising to the presidency in 1935. Mr. Hill retired in 1945 and opened a practice as consulting engineer.

Howard Whittier Holmes (M. '12), age 72, retired Montana state highway engineer, died at his home in Pacific Grove., Calif., on January 19. He was a graduate of the Vander Naillen School of Engineering, San Francisco. Most of his professional career had been with the Montana State Highway Commission, in the capacity of bridge engineer, construction engineer and state highway engineer. In 1931 and 1932 he was consulting engineer for the Louisiana Highway Commission, and earlier had been bridge engineer for the Oregon Highway Commission and bridge engineer for the City of Portland, Ore. Mr. Holmes was a veteran of World War I.

Joseph M. Kane (M. '25), age 64, assistant office engineer for the California Division of Highways until his retirement in 1956, died suddenly at his home in Sacramento on January 24. Mr. Kane went to work for the California Division of Highways in 1927. During his long career he supervised the preparation of job specifications on more than two billion dollars worth of highway construction, and had charge of the production of the Division's "Standard Specifications" for more than a quarter of a century. Earlier he was with the Nevada Department of Highways, which he had served as chief testing engineer and office engineer. He was a graduate of the University of California and a veteran of World War I.

Clarence Burton Long (A.M. '09), age 74, partner in the engineering firm of Long Bros., Los Angeles, Calif., died at his home there recently. He attended the University of Knoxville and afterwards was employed in the engineering department of the Southern Railway Co. for several years. Mr. Long then joined the U. S. Reclamation Service on the Lower Yellowstone Project in Montana, remaining with this service for twelve years on projects in Montana, Idaho and Washington. In 1920 he went to California and with his brother opened an office for the practice of structural work and real estate.

Kenneth W. Lefever (M. '41), age 59, consulting engineer of Little Rock, Ark., died suddenly in Jackson, Miss., on February 21 while attending the ASCE Jackson Convention. Mr. Lefever had been in private practice for the past twenty years. He designed and was consulting engineer on a large water supply at Little Rock and had just finished the designs for an industrial sanitary system for Little Rock. Earlier he was associated with Lord & MacCrea, of Little Rock, on municipal and highway work and had been an engineer with the Arkansas Highway Department. He was a former president of the Mid-South Section.

Nathan Bert Higgins (M. '41), age 72, retired president of the Safe Harbor Water Power Corporation, Baltimore, Md., died recently at his home in Ruxton, Md. A graduate of Pennsylvania State College, class of 1909, Mr. Higgins had been a structural estimator with the Baltimore Bridge Company and designer-erector for the Western Maryland Railway. In 1914 he joined the Pennsylvania Water and Power Company, which he later served as assistant chief engineer, chief engineer, and advisory engineer. When the Safe Harbor Water Power Corporation was formed, Mr. Higgins became its assistant chief engineer and later was made chief. In 1942 he was promoted to the presidency, in which capacity he remained until his retirement in 1955.

Constantin P. Melioransky (M. '48), age 68, an assistant division engineer in the design department of the New York City Board of Water Supply, died there recently. Mr. Melioransky had been with the Board since 1938, and recently was engaged on the design of dams, spillways, and bridges in connection with its Delaware River supply project. A native of Russia, Mr. Melioransky, received a degree from the Imperial Institute of Civil Engineers in St. Petersburg, coming to this country in 1924. He was assistant structural design engineer for the New York Central Railroad for fourteen years prior to joining the Board of Water Supply.

Frank R. Molther (M. '32), age 63, who retired recently as valuation engineer for the Panama Canal Company at Balboa Heights, C. Z., died recently at Ancon, C. Z. Mr. Molther had a long and interesting career in Central and South America. His work included several years as office engineer for R. W. Hibard & Co., Inc., in Colombia. In his early career he had been an inspector in charge of a survey boat and party for the Mississippi River Commission. Mr. Molther was educated at Cornell University, class of 1917.

Charles F. Niles (M. '56), age 61, civil engineer with the U. S. Forest Service, Russellville, Ark., died at his home there recently. A graduate of the University of Maine, class of 1919, Mr. Niles received his civil engineering degree there in 1925. Mr. Niles spent his early career with the Delaware State and North Carolina State Highway Commission in various capacities. From 1928 to 1931 he was resident engineer for the Tennessee State Highway Department in Nashville. He joined the U. S. Forest Service in 1933 as assistant highway engineer, advancing to responsible charge of planning, programming, design, construction and maintenance.

Raymond L. Paulus (A.M. '32), age 55, engineer with the W. C. Babcock Construction Co., Inc., of Rensselaer, Ind., died recently at Lafayette, Ind. He received a degree in electrical engineering from the University of Wisconsin in 1922. Shortly after graduation Mr. Paulus became associated with the Allis-Chalmers Mfg. Co., working in the hydraulic engineering department for eight years. He joined the Babcock Company in 1930.

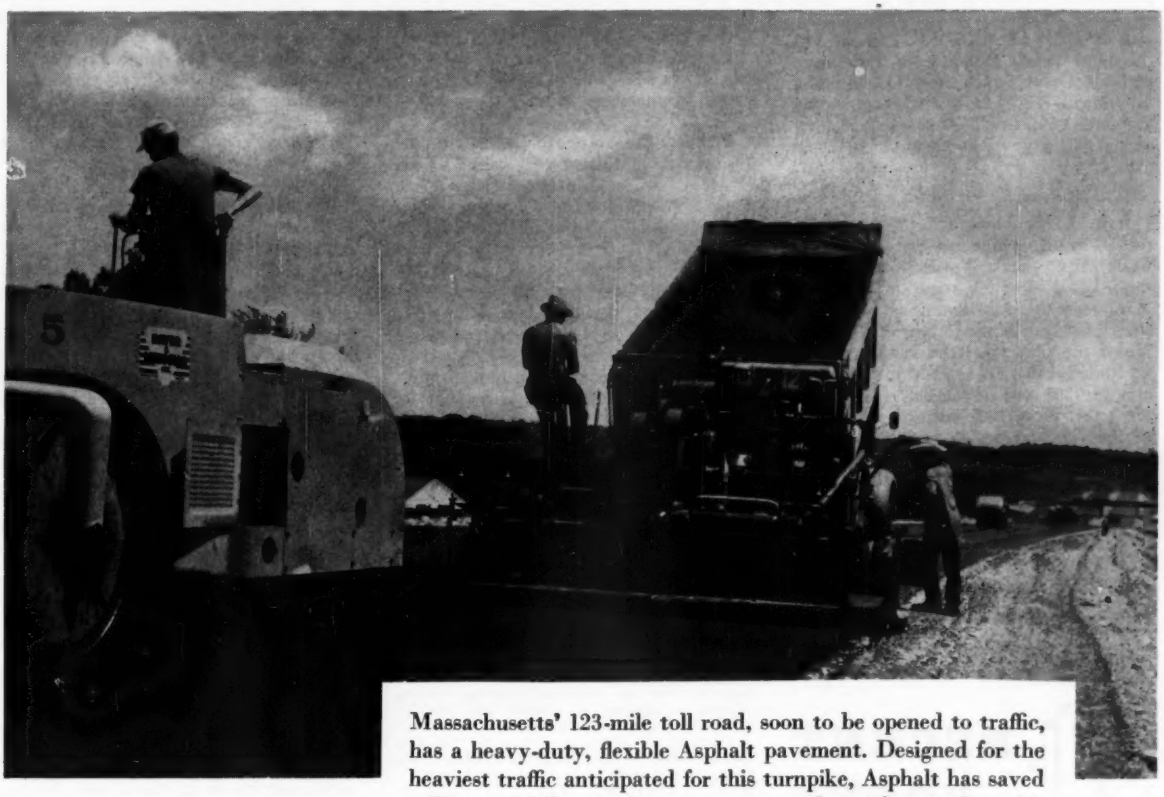
Sydney L. Rothery (M. '25), age 78, consulting engineer of South Pasadena, Calif., died at his home there recently. Mr. Rothery had been in private practice since 1925. A native of Australia, he was a graduate of Sydney Technical College. His early experience included work with T. H. Houghten, building constructor and mechanical designer of Sydney, and work as an assistant engineer on railroad construction for the New South Wales Government. Coming to this country in 1918, he was associated with the Imperial Irrigation District Municipal Corp. as office engineer on irrigation of land in southern California and Mexico.

Floyd W. Sayers (A.M. '21), age 67, engineer with the Missouri State Highway Department at Jefferson City, Mo., died recently at his home at Anaheim, Calif. With the exception of four years as assistant city engineer of Lafayette, Ind., Mr. Sayers spent his entire career in the Highway Department. He became connected with the department in 1919 at Charleston, Mo., and in 1929 was transferred to Jefferson City. He was a civil engineering graduate of Purdue University, class of 1914.

Henry J. Senecal (A.M. '37), age 60, civil engineer with the Bethlehem Pacific Coast Steel Co., Los Angeles, Calif., died there recently. From 1924 to 1936 Mr. Senecal was with the McClintic-Marshall Co., at Pittsburgh and Bethlehem, Pa.,

(Continued on page 104)

Heavy-duty Asphalt cuts cost of Massachusetts Turnpike



Constructing a heavy-duty, resilient Texaco Asphaltic Concrete pavement on 27 miles of the new Massachusetts Turnpike.

CONTRACTOR — The Bayer & Mingolla Construction Company, Worcester, Mass.

Massachusetts' 123-mile toll road, soon to be opened to traffic, has a heavy-duty, flexible Asphalt pavement. Designed for the heaviest traffic anticipated for this turnpike, Asphalt has saved millions of dollars in first cost, compared to other paving with the same load-carrying capacity.

The photograph shows a 3-inch hot-mix Texaco Asphaltic Concrete surface, constructed in two courses on 27 miles of the Massachusetts Turnpike. Supporting this surface are two 2½-inch layers of crushed stone, the upper one penetrated with asphalt cement by pressure distributor, the lower one sand-filled. Under this, there is a 12-inch gravel sub-base.

Texaco Asphalt products provide the road builder with answers to all his paving problems, whether he is building a heavy-duty pavement for a New England toll road, or a low-cost surface for a Wisconsin farm-to-market road. Helpful information on methods and materials recommended for all types of asphalt road and street construction is supplied in two booklets. Copies may be obtained without obligation by writing our nearest office.

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Boston 16 • Chicago 4 • Denver 1 • Houston 1 • Jacksonville 2 • Minneapolis 3 • Philadelphia 2 • Richmond 19

TEXACO ASPHALT

Deceased

(Continued from page 102)

and from 1936 on with its successor organization, Bethlehem Steel. He worked on many projects for Bethlehem Steel, including the Cathedral of Learning and the Gulf Office Building in Pittsburgh and the Great Lakes Steel Co. building in Detroit. He was a civil engineering graduate of Cornell, class of 1919, and served as a first lieutenant in World War I.

Irvin L. Simmons (M. '28), age 84, retired bridge engineer with the Chicago, Rock Island & Pacific Railroad of Chicago, Ill., died at his home in Jonesville, Wis., recently. Mr. Simmons graduated from Michigan State College in 1897. He joined the Chicago, Rock Island & Pacific Railroad in 1903 as assistant engineer, and in 1906 was appointed chief bridge inspector. From 1909 until his retirement in 1944 he was bridge engineer. In the latter capacity he worked on many projects including the White River Lift Bridge, the Joliet Lift Bridge, Kaw River bridges, and the Mississippi River Slough.

Dennis Stephen Waibel (J.M. '55), age 31, junior engineer for the City Engineer's office in San Diego, Calif., was killed recently in an airplane crash while on duty in the Naval Reserve. Mr. Waibel was a graduate of the University of Minnesota in 1950 and received his civil engineering degree from the University of Washington in 1955. Shortly after graduation he joined the staff of the City Engineer's office in San Diego. His home was in Minneapolis, Minn.

William H. Warnecke (A.M. '20), age 73, retired consulting engineer, died recently at his home in Los Angeles. From 1921 to 1948 Mr. Warnecke was in private practice in New York and Connecticut, specializing in a wide variety of construction work. Early in his career (1906 to 1917) he was with the New York Central in a variety of capacities. In World War I he served as a captain in the Navy Civil Engineer Corps. Mr. Warnecke was a technical author of note, his publications including a manual for the West Point Engineer School and works on bridge and building foundations, structural steel design, and design and construction of reinforced concrete.

Paul Robert Watson (M. '27), age 72, retired bridge engineer for the California Division of Highways, died at his home in Pacific Grove, Calif., on January 26. At the time of his retirement in 1955 Mr. Watson was in charge of advance planning of freeway structures in metropolitan Los Angeles. Earlier (since 1933) he had been engineer for the Division on important structures such as the Santa Monica Tunnel and the Sacramento River Bridge at Red Bluff. Prior to 1933 he was engaged in private practice in San Diego in the firm of Watson, Valle & Gough. He was a graduate of Stanford University and a past-president of the San Diego Section.

Francis G. Wrightson, Jr. (A.M. '14), age 73, retired assistant to the general manager of the Bethlehem Steel Company and the management's representative at the Sparrows Point (Md.) plant, died recently as a result of injuries received in an automobile accident. His home was in St. Michaels, Md. A graduate of Lehigh University, Mr. Wrightson joined Bethlehem in 1918 as division engineer in charge of construction of the No. 2 open hearth and the 60-inch plate mill at Sparrows Point. Later he was superintendent of the plate finishing mills. From 1930 until his retirement in 1952 he was in charge of industrial relations.

RECENT BOOKS

(Added to the Engineering Societies Library)

Elastic Behavior Of Structural Members

The Frame Constant Method

The method of structural analysis presented in this book by Odd Albert is based upon "The various deflections of the free end of a member considered as a fully restrained cantilever beam with all the direct loads applied and the influences of all other members in the system considered as loads." The author provides detailed analyses of a variety of structural members, discussing elastic behavior, moment equations, the unit beam, the general behavior of the continuous girder, and continuous girders of from two to six spans. Charts and tables are included as necessary. The present volume considers only structural members with constant moment of inertia. (Opla Company, Box 266, Belmar, N. J. 1956. Various pagings. $6.00.)

International Association For Bridge And Structural Engineering

Twenty-eight papers, 16 in English, 6 in French, and 6 in German, with titles and summaries given in the three languages. Some examples of the topics covered in the papers are analysis of thin-walled continuous shells; scale model investigation of shell roofs; a method for calculating circular cylindrical shells; the plastic design of aluminum structures; vibrations in steel and reinforced concrete bridges; impact accompanied by fatigue; and assembly by prefabricated reinforced concrete components for hangars. (Publications, Volume 16, 1956. Verlag Leemann, Zürich, Switzerland. 550 pp., paper. Price not given.)

Pump Selection and Application

The first sixty pages of this practical manual describe the classes and types of modern industrial pumps, emphasizing what can be expected from each type. The remainder of the book is about equally divided into two sections—the first a detailed consideration of factors in pump selection, the second a series of specific discussions of pumps used in more than a score of industries, including power, petroleum, nuclear energy, water supply, sewage, irrigation, and mining. (By Tyler G. Hicks. 1957, McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, N. Y. 422pp., bound. $8.50.)

Structures

This book by Pier Luigi Nervi—the inventor of "Ferro-cemento," a reinforced concrete with the strength of steel—sums up over forty years' experience with structural design. Pier Luigi Nervi has the unique experience of being able to conceive, design, and build his own structures. In these pages he clearly presents his thoughts on such subjects as building correctly, economy in construction, professional training for the designer, and reinforced construction. Many photographs and sketches illustrate his techniques. The book was published in Italian in 1955 under the title "Costruire Corettamente." (1956, F. W. Dodge Corp., 119 West 40th Street, New York 18, N. Y. 118pp., bound. $6.95.)

Theory of Land Locomotion

(The Mechanics of Vehicle Mobility)

A comprehensive compilation of the information now available on the relationships between an operating motor vehicle and its physical medium, particularly in off-the-road locomotion. The subjects covered include locomotion in nature and on wheels, problems of soil and snow mechanics, track-laying vehicles, motor vehicle mechanics, trafficability of soils, and dimensional analysis. A bibliography of some 350 references is included. (By M. G. Bekker. 1956, The University of Michigan Press, Ann Arbor, Mich. 520pp., $12.50.)

Wood Structural Design Data, Vol. I

Third Edition, 1956.

This new edition includes significant developments in the field which have occurred since the publication of the second edition in 1939. Among these are the timber-connector system of wood construction, structural glued-laminated lumber, simplified methods of column design, and more specific information on the relation of load duration to allowable stresses. Since this is intended as a practical reference aid for wood structural design, the data are presented for the most part in tabular form. There is a subject bibliography at the end. (1956. Published by the National Lumber Manufacturers Association, 1319 18th Street, N.W., Washington 6, D. C. 362pp., $4.00.)

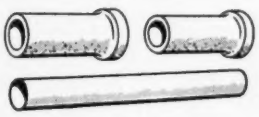
Library Services

Engineering Societies Library books may be borrowed by mail by ASCE members for a small handling charge. The Library also prepares bibliographies, maintains search and translations services, and can supply photoprint or microfilm copies of any items in its collection. Address inquiries to Ralph H. Phelps, Director, Engineering Societies Library, 29 West 39th Street, New York 18, N.Y.

City officials, engineers, contractors will be interested in these . . .

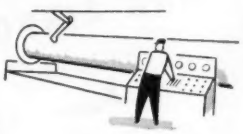
Facts About Steel Water Pipe

COMPARE THE COSTS . . .



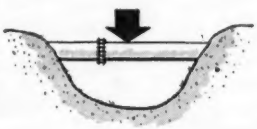
This scale drawing compares a single 40-ft length of steel pipe with two 16-ft lengths of rigid-walled pipe of the same inside diameter. The steel pipe has thinner walls and a smaller outside diameter; weighs only about one-fifth as much per ft of length. Results: the steel pipe costs less to ship and handle; requires a smaller ditch, fewer bell holes, fewer joints—only 132 per mile.

TESTED FOR STRENGTH . . .



Every length of steel pipe is hydrostatically tested at the shop in accordance with AWWA specifications—usually to double the working pressure. What's more, steel pipe can withstand from 3 to 4 times the working pressure before bursting! It safely resists water-hammer, shock loadings and surge.

BEAM STRENGTH . . . Steel pipe has the structural strength that is characteristic of tubular steel. It can span long washouts; is often handled in multiple lengths during installation. And steel pipe can stand up under the weight of extremely heavy cover.



RESILIENCE . . . Steel "gives" under stresses that would cause more rigid materials to crack or break. Steel pipe can "absorb" traffic vibration as well as shock due to explosions and earth tremors. Its resilience allows it to transmit much of the strain to the surrounding earth. This is not true of rigid-walled pipe.

LEAKPROOF JOINTS . . .

100 pct bottle-tight joints are a practical reality with steel pipe, whether Dresser couplings or welds are used. Water leakage is prevented; there's no contamination of the contents due to infiltration from without. These joints are quickly made, they're permanent, and they're strong.

CORROSION-RESISTANCE

Modern methods of lining steel pipe with hot-spun coal-tar enamel make it immune to corrosion and incrustation. There is no known time limit to this protection. Many tar-enameled lines have been in service for upwards of fifty years. Coal-tar enamel provides the smoothest surface obtainable, assuring high flow coefficients year after year. Coatings and wrappings protect the pipe exterior from moisture, acids and alkalis.

WIDELY USED . . . Large-diameter steel pipe is the growing choice of planners of municipal and industrial water systems. Some recent users of Bethlehem Steel Pipe are: New York City, New Orleans, Philadelphia, Savannah, Reading, Cincinnati, Atlanta, Omaha, Worcester, Colorado Springs and Boston. Further proof of the superior qualities of steel pipe is its use in thousands of miles of large-diameter gas and oil lines, as well as in high-pressure penstocks throughout the world.

If you would like to have further information about steel water pipe, kindly call or write to the Bethlehem sales office nearest you.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Here's the greatest Steel ....ever offered!!

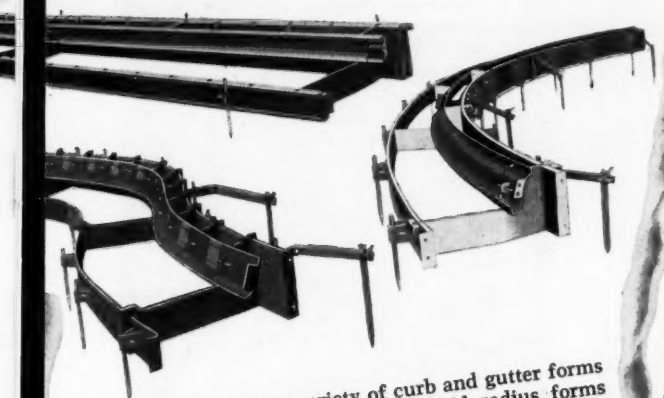
HIGHWAY AND AIRPORT FORMS

Redesigned Road Forms engineered by America's foremost form builder, are stronger, easier to align, faster setting than ever before. Built to contractors specifications, these new forms will take plenty of punishment and give years of service. They are now available with or without upturned base flange.

Heltzel's husky Dual Duty Forms have long been the favorites of contractors who build airport runways and ramps. These forms come in a number of double faces to enable contractors to pour two slab thicknesses with the same form.

Form Value

CURB AND GUTTER FORMS



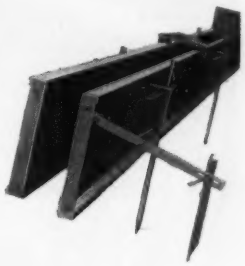
Heltzel builds the widest variety of curb and gutter forms in the industry. Straight, flexible or rigid radius forms for any face and style. You'll want to know about the combined curb and gutter forms with the interchangeable sections that permit many styles from the same basic set . . . a real cost saver!

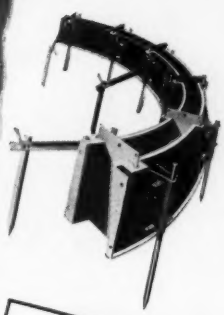
SIDEWALK FORMS

Here's an improved design sidewalk form with built-in Heltzel quality that assures lifetime performance. Division plate slots are spaced in one foot increments for better pouring practice.

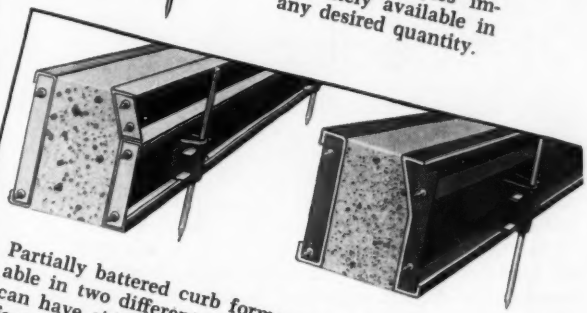
CURB FORMS

Heltzel Curb Forms now have full length stake pockets that add to form rigidity—make staking faster, more positive. Forms are made of prime steels



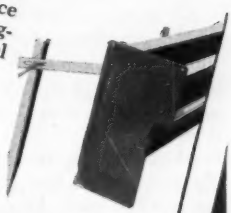


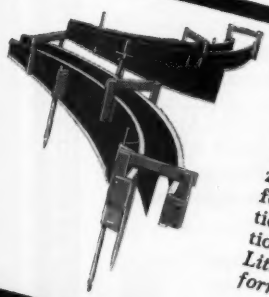
that have rerolled rail stakes. Battered or straight face in straight, fixed or flexible radius styles immediately available in any desired quantity.



Partially battered curb forms are available in two different types. Contractors can have either the single or two piece form. Both have the strength and ruggedness that is typical of Heltzel Steel Forms.

Adjacent forms for adding curbing to slabs already in are available in the widest variety of combinations.





SPECIAL FORMS

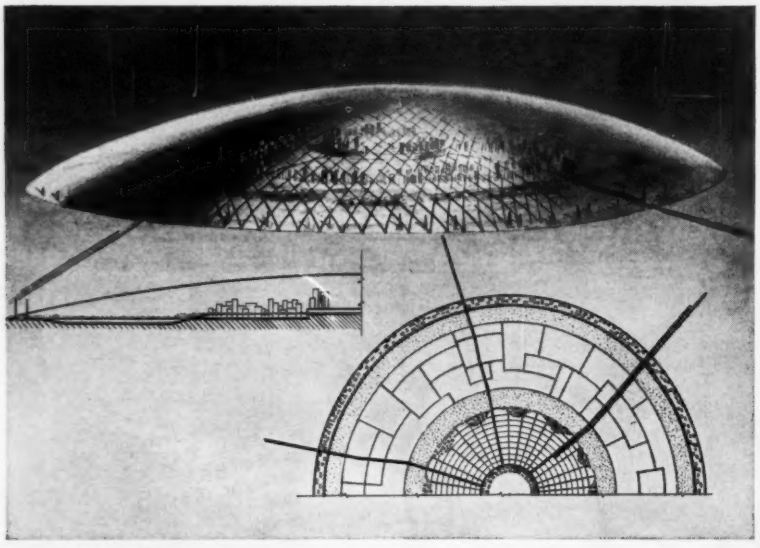
Whatsoever your forming needs it pays to specify Heltzel Forms. Heltzel will build forms to meet any specifications — for islands, foundations, driveways, piling, etc. *Literature available on all form types and styles.*

247

HELTZEL STEEL FORMS

THE HELTZEL STEEL FORM AND IRON CO., 402 THOMAS RD., WARREN, OHIO

MARS outstanding design **SERIES**



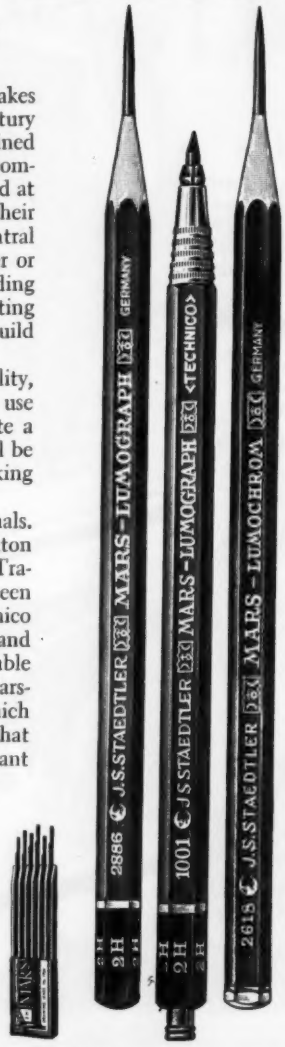
21st century city

The shallow, plastic-faced, Geodesic dome makes this city of the future look strange to 20th century eyes. But designer Philip H. Seligson has combined practical economics with creative thinking in committing his concept to paper. Industries are located at the outer circumference of the city; discharge their smoke through stacks that pierce the dome. Central air conditioning controls the temperature—winter or summer the climate is perfect. Instead of building their own four weather walls and roof, insulating them, heating and cooling them, people can build their walls merely as grilles and curtains.

No matter which of today's ideas become reality, it will be as important tomorrow as it is today to use the best of tools when pencil and paper translate a dream into a project. And then, as now, there will be no finer tool than Mars—from sketch to working drawing.

Mars has long been the standard of professionals. To the famous line of Mars-Technico push-button holders and leads, Mars-Lumograph pencils, and Tradition-Aquarell painting pencils, have recently been added these new products: the Mars Pocket-Technico for field use; the efficient Mars lead sharpener and "Draftsman's" Pencil Sharpener with the adjustable point-length feature; and—last but not least—the Mars-Lumochrom, the new colored *drafting* pencil which offers revolutionary drafting advantages. The fact that it blueprints perfectly is just one of its many important features.

The 2886 Mars-Lumograph drawing pencil, 19 degrees, EXEXB to 9H. The 1001 Mars-Technico push-button lead holder. 1904 Mars-Lumograph imported leads, 18 degrees, EXB to 9H. Mars-Lumochrom colored *drafting* pencil, 24 colors.



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Non-ASCE Meetings

American Materials Handling Society. Seventh National Materials Handling Exposition at Convention Hall, Philadelphia, Pa., April 29-May 3. Information from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

American Planning and Civic Association. The 1957 National Planning Conference of the American Planning and Civic Association will be held at the Hotel Marion, Little Rock, Ark., June 9-12. Information from James A. Hatcher, Conference Director, Metropolitan Area Planning Commission of Pulaski County, 209½ West Second Street, Little Rock, Ark.

American Society of Mechanical Engineers. Second Design Conference will be held in conjunction with the Design Engineering Show at the New York Coliseum, N. Y., May 20-23. Information from Clapp & Poliak, Inc., 341 Madison Avenue, New York 17, N. Y.

American Water Works Association. AWWA Annual Conference to be held in Atlantic City, N. J., May 12-17. Information from AWWA, 2 Park Avenue, New York City, N. Y.

Building Research Institute. Sixth Annual Meeting of the Building Research Institute will be held at the Drake Hotel, Chicago, Ill., April 15-17. Information from Building Research Institute, 2101 Constitution Avenue, Washington 25, D. C.

Colorado School of Mines. Second Annual Symposium on Rock Mechanics sponsored by the Colorado School of Mines at Golden, Colo., April 21-24. For information write to the Department of Mining Engineering, Colorado School of Mines, Golden, Colo.

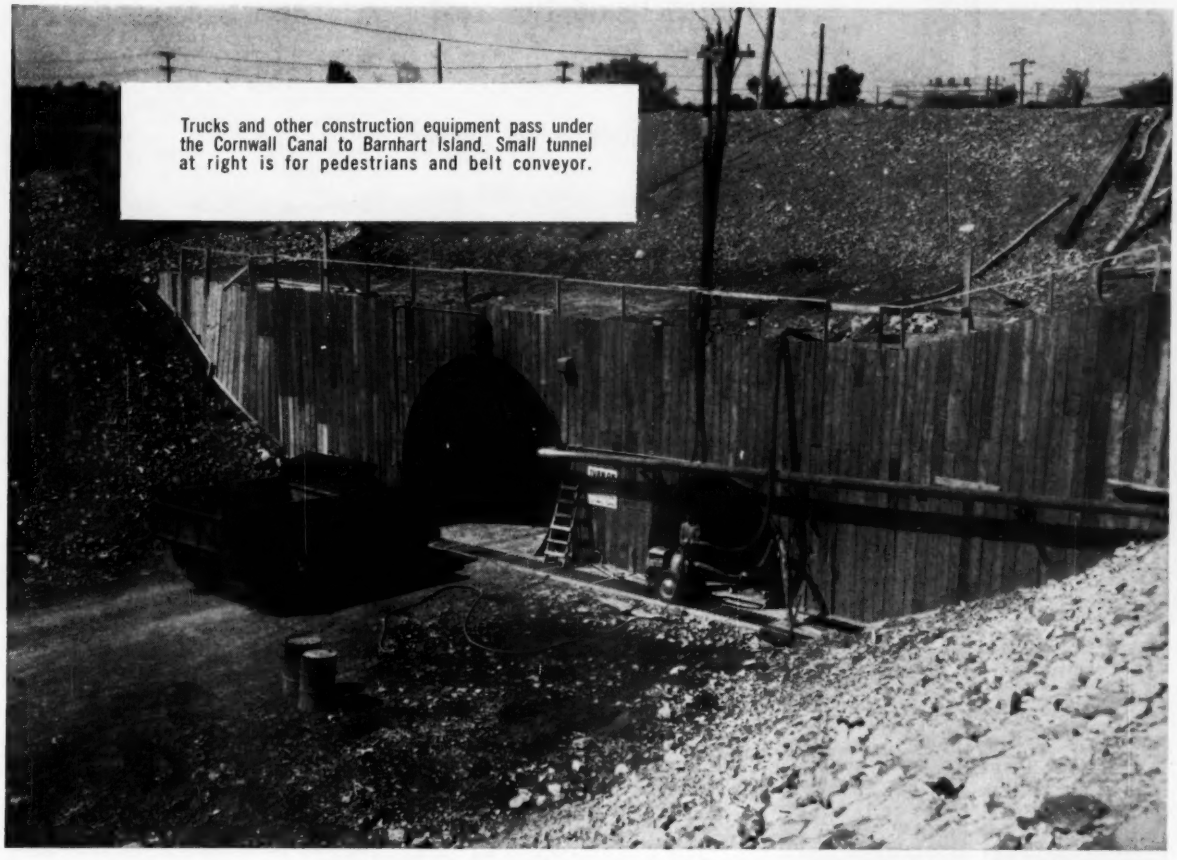
Construction Surveyors Institute. Thirty-First Anniversary Conference of the Institute will be held at the Hotel Washington, Washington, D. C., May 13-15. Information from G. Szmak, Secretary, Construction Surveyors Institute, 101 Park Avenue, New York 17, N. Y.

Purdue University. Purdue Industrial Waste Conference at the Purdue Memorial Union Building, May 13-15. Information from Don E. Bloodgood, Professor of Sanitary Engineering. Purdue University, LaFayette, Ind.

University of Texas. The Forty-Eighth Annual Exposition and Power Show of the University of Texas will be held on the campus at Austin, Tex., May 3. Information from T. A. Carlton, Public Relations Chairman, The University of Texas, Austin, Tex.

Armco Products Help

speed construction on St. Lawrence Seaway



Trucks and other construction equipment pass under the Cornwall Canal to Barnhart Island. Small tunnel at right is for pedestrians and belt conveyor.

The St. Lawrence Seaway, one of the largest construction projects of all time, is scheduled to open in 1959. Armco Construction Products are helping maintain the rapid pace of construction.

For example, large Armco MULTI-PLATE® Pipes provide access tunnels for equipment, men and materials under the Cornwall Canal between the Canadian shore and the construction site of the Barnhart Island powerhouse. The pipes, 10 and 16½ feet in diameter, were installed in an open cut across the canal after winter ice had stopped ship traffic. Cofferdams held back the water above and below the site. Despite subfreezing weather, the curved, corrugated plates were quickly bolted together to form the tunnels. The cut was then backfilled and the canal banks rebuilt well in advance of spring canal traffic.

Armco Drainage and Construction Products also are being used on other projects for the Seaway. Drainage structures under many of the relocated highways are Armco Corrugated Metal Pipe. Armco Steel Buildings provide sturdy, weathertight structures for project offices, materials warehouses, and equipment maintenance and repair shops. And Armco MULTI-PLATE provides aggregate conveyor tunnels.

There is a size and type of Armco Product to help you solve practically any drainage or construction problem. Write us for helpful, authoritative data. Armco Drainage & Metal Products, Inc., 4447 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation. In Canada: write Guelph, Ontario. Export: The Armco International Corporation.

ARMCO

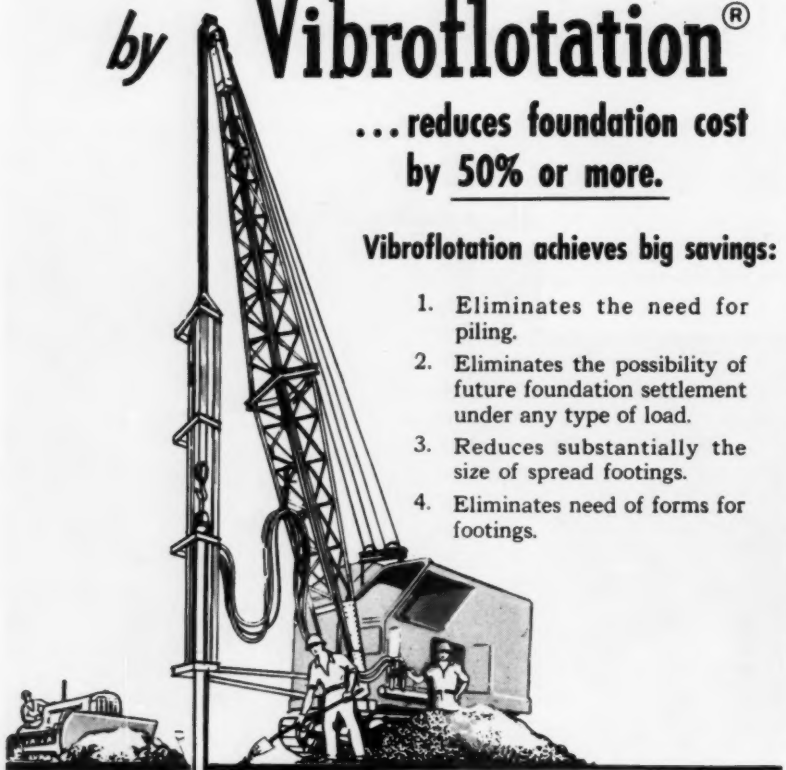
CONSTRUCTION PRODUCTS

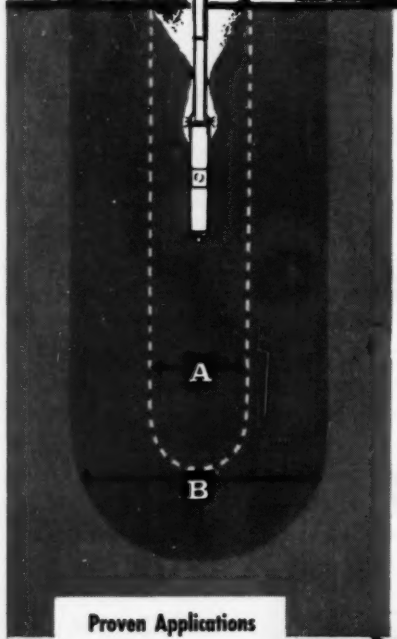
Compaction of loose, granular soil by Vibroflotation®

...reduces foundation cost by 50% or more.

Vibroflotation achieves big savings:

1. Eliminates the need for piling.
2. Eliminates the possibility of future foundation settlement under any type of load.
3. Reduces substantially the size of spread footings.
4. Eliminates need of forms for footings.





VIBROFLOTATION can compact loose granular soil to any required depth—from the surface to 100′ or more.

The Compact Cylinder of Soil

A. A 3′ approximate diameter cylinder of compacted material that has been added from the surface to compensate for the loss of volume caused by the increase of density of the compacted soil.

B. A 10′ approximate diameter cylinder of compacted material produced by a single Vibroflotation application.

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New Publications

Highway bridges . . . To aid highway officials in improving engineering productivity in this period of accelerated highway construction, the U. S. Bureau of Public Roads is making available a new edition of "Standard Plans for Highway Bridge Superstructures." The 52-page book comprises 18 series of standard plans, which furnish details for a variety of bridge types. Entirely new are three series for pretensioned precast concrete and five series for structural timber. Designs are based on two roadway widths—24 ft with H15-44 live load and 28 ft with H20-44 live load. Copies priced at $1.75 each, are available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Engineering as a career . . . Printed copies of the employment practices criteria adopted by the National Society of Professional Engineers are now available from the organization's headquarters at 2029 K Street, N. W., Washington, D. C. Printed in check-list form, the criteria cover specific categories of career development. Prices range from 25 cents for a single copy to 10 cents a copy in quantity orders of 100 or more.

Civil engineering refresher . . . Another helpful pamphlet in William Glendinning's refresher series for engineers preparing for the New York State Professional Engineer Examinations is now available from the author. The new publication consists of selected problems and their solutions for Civil Engineering Examination, Part III. Requests should be sent to Mr. Glendinning at 5123 Bell Boulevard, Bayside, N. Y. Copies are $3.00 each.

Scientific and engineering personnel . . . Release of a Supplement to Bulletin 26, the "Conference Leader's Guide for Supervision of Scientific and Engineering Personnel" (February issue, page 108), is announced by the Industrial Relations Section of the California Institute of Technology. John T. Lloyd and Robert D. Gray are authors of the supplement, which is identified as Bulletin 26 A. The two volumes may be purchased as a set for $8.75 from the Bookstore, California Institute of Technology, Pasadena, Calif. Quantity prices will be quoted on request.

Careers in atomic industry . . . In a 34-page, illustrated booklet on "Careers in Nuclear Science and Engineering," the Atomic Industrial Forum has made available the substance of its September 1956 conference for high school science students co-sponsored by the Chicago Junior Association of Commerce and Industry. Copies are 10 cents each and may be obtained from the Atomic Industrial Forum, 3 East 54th St., New York 22, N. Y.

Separation of suspensions . . . Patents (United States and foreign) issued for clarification, sedimentation, and thickening equipment are reviewed by William L. Barham, Joseph L. Matherne, and Arthur G. Keller in Bulletin No. 54 of the Engineering Experiment Station at Louisiana State University. The survey covers the period, 1849-1954. The patents found satisfactory for the treatment of suspensions are discussed and illustrated in the order of their date of issuance. Copies, priced at $2.00 apiece, may be obtained from the Engineering Experiment Station at Louisiana State University, Baton Rouge, La.

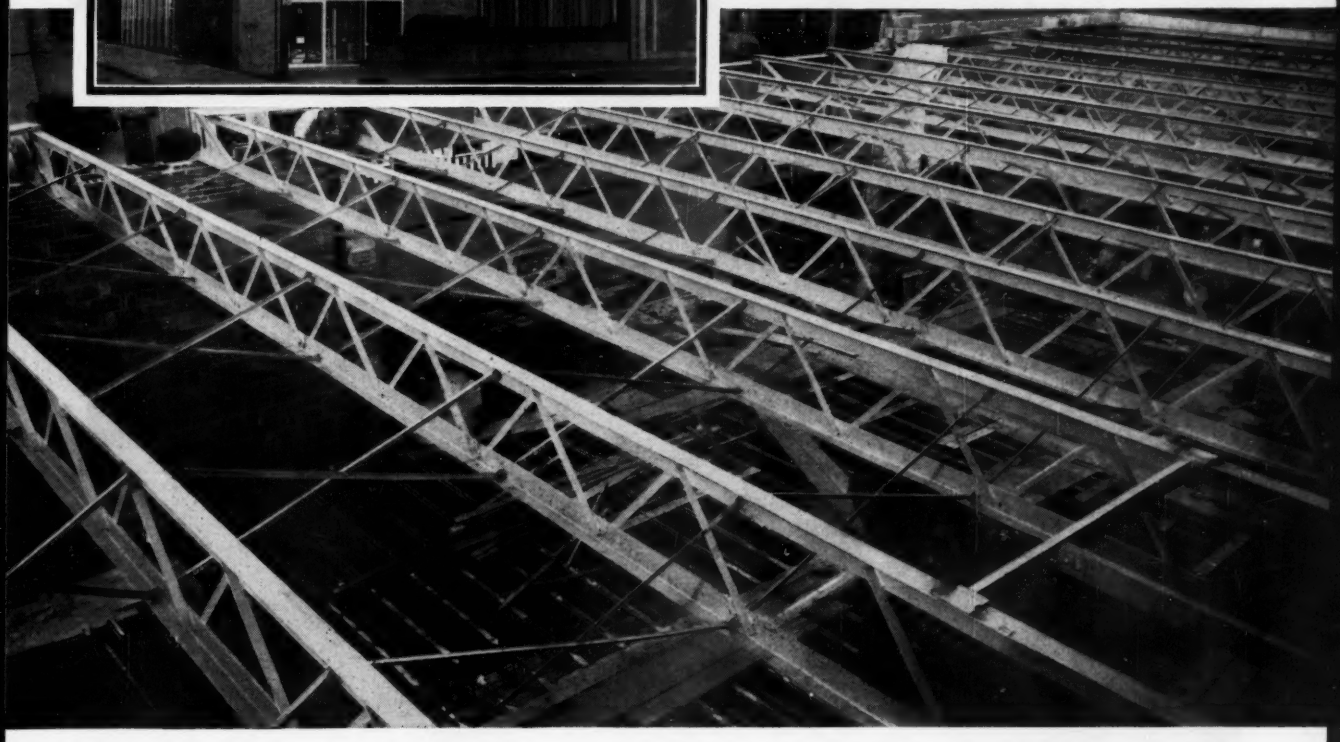
Italian dams . . . "Dams for Hydroelectric Power in Italy" is the overall title of a magnificent seven-volume work, which has been published in separate Italian, French, and English editions by Anidel, Milan, Italy. Profusely illustrated, the volumes include working plans for each of the 196 major dams built in the past fifty years. The authors are engineers and technicians connected with the principal electric utility companies in the country. Inquiries about the price (around $200 for the set) and other details should be sent to Anidel, which has a descriptive pamphlet on the set.

(Continued on page 128)

MELLON NATIONAL BANK (BRANCH OFFICE BUILDING)
SEWICKLEY, PENNSYLVANIA

DESIGNS BY HOFFMAN & CRUMPTON, ARCHITECTS
PITTSBURGH, PENNSYLVANIA

CONTRACTORS: MARTIN & NETTROUR, CONTRACTING CO.
PITTSBURGH, PENNSYLVANIA



Perfect for small jobs like this—

AMBRIDGE STEEL JOISTS

AmBridge Steel Joists arrive at the site completely shop-fabricated, ready to erect. Their light weight, combined with the simplicity of end connections and accessories, appreciably reduces man-hours of erection time. No special equipment or falsework is needed.

This one-story, 52′ x 100′ branch office building is strong and safe *as a bank should be.* For not only was it built around a heavy steel frame, but its floor and roof are supported by steel.

In addition to furnishing 16,700 pounds of structural steel for the frame, American Bridge also supplied 25,000 pounds of AmBridge long-span Steel Joists and 15,600 pounds of AmBridge standard Steel Joists for floor and roof construction.

USS AmBridge Steel Joists provide rigid, lightweight and economical construction suitable for any type of floor, roof and ceiling. The underslung and open-web design provides for maximum head room and allows passage of pipes, ducts and conduits in any direction.

In floor construction, the ease and simplicity of handling reduces installation time to a minimum and permits other trades to begin their work promptly. And, for roof construction, these modern, new-design joists cut the time required to put your structure under cover.

For detailed information about the time- and money-saving advantages of using USS AmBridge Steel Joists on your next job, get in touch with our nearest Contracting Office, or write direct to Pittsburgh for a free copy of our 36-page catalog. It is the only complete steel joists catalog with design information for spans up to 120 feet. Ask for your copy today, or see it in Sweet's Files.

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AMBRIDGE STEEL JOISTS

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UNITED STATES STEEL

CLYDE R. HARVILL,
Superintendent,
San Jacinto Water System,
City of Houston
Utilities Dept.

The Houston Water Purification Plant was one of the first plants to use rubber-seated butterfly valves in filter service. Freese, Nichols and Turner, Consulting Engineers, chose R-S Rubber-Seated Butterfly Valves over conventional gate valves for all low-pressure service because their compact design permitted close coupling of pipe. Result: a substantial saving in space, and a direct, in-place cash saving of $124,000.

Houston, Texas, Reports: COMPLETELY SATISFIED WITH R-S BUTTERFLY VALVE OPERATION

When the Houston Purification Plant went into operation in 1954, 65 R-S Rubber-Seated Butterfly Valves were used to equip the entire low pressure system. Today, Mr. Harvill reports that these valves are giving good service, and that he is fully satisfied with their performance and minimum maintenance requirements during their first years of operation.

R-S Rubber-Seated Butterfly Valves are easy to operate, and will provide 100% effective shut-off with a 125-pound pressure drop. Wedging action of the vane against the tough, flexible rubber seat assures positive closure, even around shaft bosses. The special composition of rubber and other materials gives long wear and resistance to the abrasive action of material flow.

To obtain complete information on the full SMS line – Butterfly Valves, Rotovalves and Ball Valves – see our local representative, or write S. Morgan Smith Company, York, Penna.

S. MORGAN SMITH HYDRODYNAMICS

AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED, TORONTO

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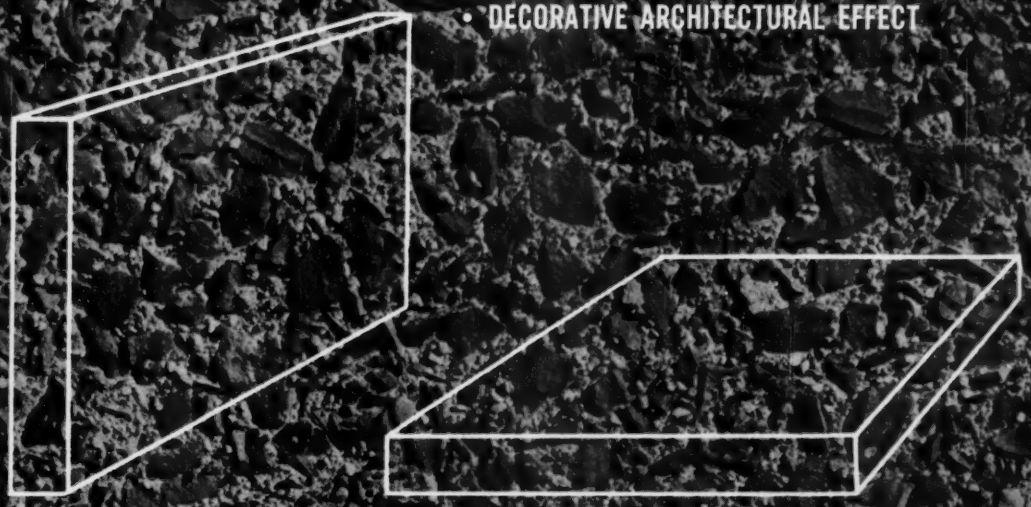

RUGASOL-F

RETARDANT FORM COATING

Rugasol-F is painted directly on formwork. When forms are stripped (2 to 5 days), the retarded surface mortar is removed with a jet of water or stiff brush.

(Rugasol-F was formerly designated Sika RFC #2 water-insoluble grade)

RUGASOL-C

RETARDANT CONCRETE COATING

Rugasol-C is applied on the surface of freshly placed concrete. On the following day, the retarded surface mortar is removed with a jet of water or stiff brush.

(Rugasol-C was formerly designated Sika RFC water-soluble grade)

You will find it easy to expose concrete aggregate with the Rugasol method. Rugasol eliminates the need for costly chipping, hacking, sand-blasting and acid washing on new construction work.

Write or call today for detailed information.

PLASTIMENT CONCRETE DENSIFIER—IGAS JOINT SEALER
RUGASOL (for exposed aggregate)—SIKACRETE ACCELERATING DENSIFIER

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"EASIER LOADING *than any others we tried*"

That's what operator Clarence Grasse says about the Allis-Chalmers TS-260 he operates on a cut-and-fill road job near Waubeka, Wisconsin.

It's the curved bowl bottom and offset cutting edge design that make the TS-260 easier to load. Dirt "boils" through the center of the load, keeps the load live, fills the bowl with 14-yard heaped loads time after time.

On road jobs like this one, the TS-260's short turning radius—a complete turn in only 30 ft—eliminates need for extra travel-to-turn areas, shortens cycle time, gets job done faster, easier.

Maneuverability and full-capacity loading are only two of many advanced-design features that make the TS-260 motor scraper outstanding in performance and dependability. See your Allis-Chalmers dealer for the full story now. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS *Engineering in Action*

BITUMULS SOIL COVER holds mulch on new-cut banks

NOW... fast, low-cost erosion control

EROSION CONTROL has long been a problem for Roadbuilders where cut-and-fill is required in construction.

Now, thanks to the combination of effective spreading equipment and the holding power of Bitumuls® Soil Cover, this problem has been largely eliminated. Our engineers have developed Bitumuls Soil Cover specifically to combat this type of erosion.

The purpose of the Bitumuls Soil Cover Treatment is to "give nature a chance" after road construction has created . . . on cut or fill . . . an exposed area. Seed retention and growth on such areas is, under any conditions, slow and hazardous. Bitumuls Soil Cover with mulch creates an artificially-held bed for seed-development that resists the action of wind and rain.

Foremost in the equipment field are the machines of the *Finn Equipment Company, of Cincinnati, Ohio,* whose "Mulch Spreader" applies this special Bitumuls adhesive with straw mulch at the rate of one-and-one-half tons of straw per acre of exposed soil. Under average conditions, each ton of straw will require from 100 to 200 gallons of Bitumuls Soil Cover.

For full information on Bitumuls Soil Cover, call our office nearest you.

TESTED, PROVED, *SPECIFIED AND USED* on thousands of acres on the Ohio, Indiana and West Virginia turnpikes, Bitumuls Soil Cover offers these advantages to any Roadbuilders:

1. **Positive adhesion**
2. **Fast, economical coverage**
3. **Easy, uniform placement, even on steepest slopes**

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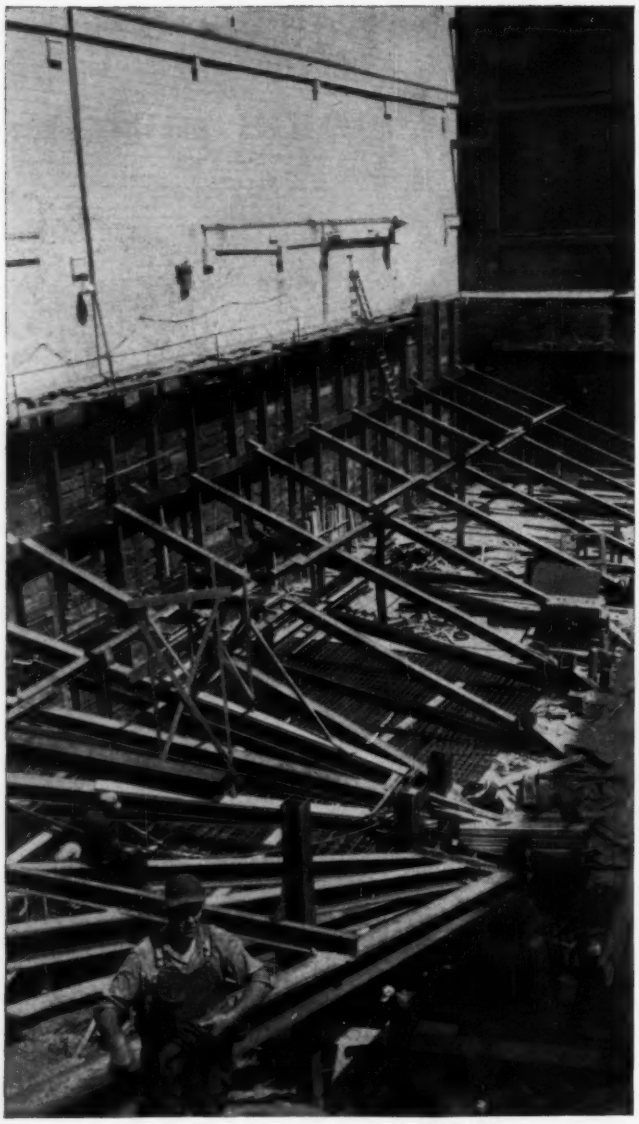

Bethlehem H-piles provide lateral support for excavation for railroad tunnel under construction at Salem, Mass. *Contractor:* Farina Brothers Co., Inc.

Construction of Boston's Fitzgerald Expressway included placing of Bethlehem H-piles as soldier beams. *Contractor:* V. Barletta Co.

◀ Soldier beams and bracing support foundation of existing buildings adjacent to new Jordan Marsh Building, under construction in Boston. *Contractor:* Spencer, White, and Prentis, Inc.

Steel H-Piles Used as Soldier Beams on Three Jobs in Massachusetts

For three important construction projects in Massachusetts, Bethlehem H-piles were used as soldier beams in open-cut excavations.

The first job is a portion of the construction of Boston's new Fitzgerald Expressway, a heart-of-the-city superhighway. Here H-piles were driven vertically on the sides of a large open cut during the building of a tunnel and ramps. The piling and its lateral bracing will prevent slides and protect existing foundations and adjacent streets.

Bethlehem H-piles were used in the same way in the construction of the new Jordan Marsh Building in Boston. Here adjacent building foundations were protected by the H-piles together with horizontal timber lagging and lateral braces.

At Salem, Mass., an open cut for a railroad tunnel was also protected by the soldier-beam method. Bethlehem H-piles retained foundations of streets on which traffic continued to move.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

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Reinforced concrete bridges start quicker . . . are completed sooner because all necessary materials and labor are readily available from local sources. These faster starts save months of delay. Furthermore, reinforced concrete is a flexible medium that permits an infinite variety of imaginative designs. Structures built with reinforced concrete are rugged . . . highly resistant to wind, shock, and quake. They are lower in first cost and require less maintenance. On your next bridge or overpass, design for beauty plus economy . . . design for reinforced concrete.

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are completed sooner

Four-span, continuous reinforced concrete girder bridge taking U. S. Route 41 over Tri-State Expressway.

Designed by the Indiana Department of Highways.

Contractor: Arcole Midwest Corporation Evanston, Illinois.

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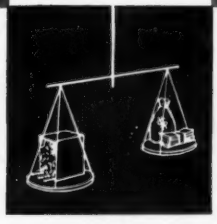

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will help bridge the

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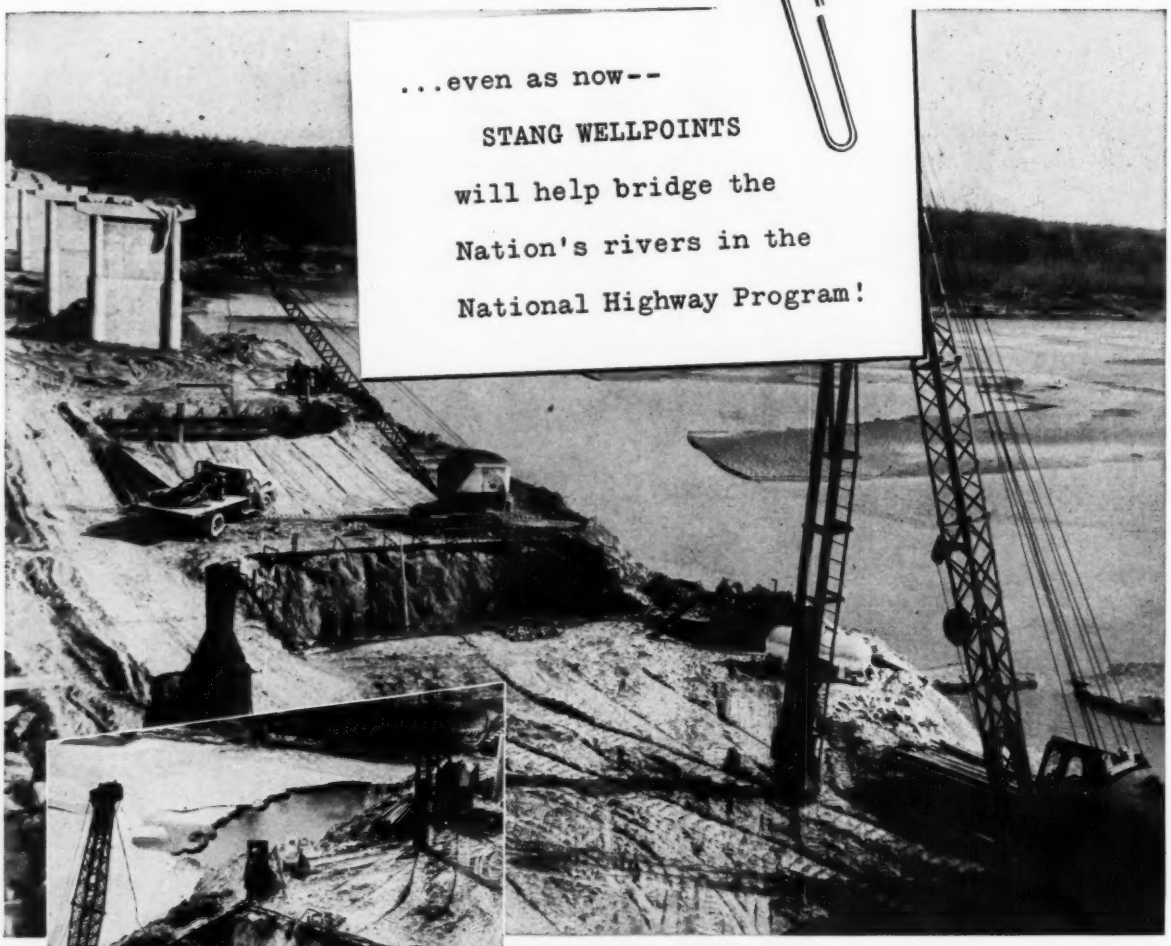

GENERAL PUMPING including High Pressure Jet Pumps, Large Capacity Sump Pumps (vertical or horizontal), Hydraulicking and Sluicing Systems and Sprinkler Irrigation Equipment.

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The Red River bridge is a joint Texas-Oklahoma project under the direction of the Texas Highway Department, Mr. John G. Simpson, resident engineer.

The Contractor: Imperial Paving Co., of Oklahoma City; Ray Lynch, General Superintendent; John Hurst, Job Supt.

The Project: Bridging the Red River on U. S. Highway 77 between Marietta, Oklahoma and Gainesville, Texas.

The Problem: To erect 13 reinforced poured concrete piers across the Red River necessitating excavation up to a maximum depth of 16 feet below water level.

The Solution: Installing a Stang Wellpoint system progressively around each pier location on a previously constructed earthen dyke thus lowering the ground water level to the required depth.

Result: A completely dry working area in a water-saturated riverbed making possible a *time-saving and profitable job!*

Call on STANG engineers for experienced services and special equipment to solve your water handling problems—any size, any type, *anywhere!* STANG engineers are on call in your area for consultation day or night.

Putting water in its place

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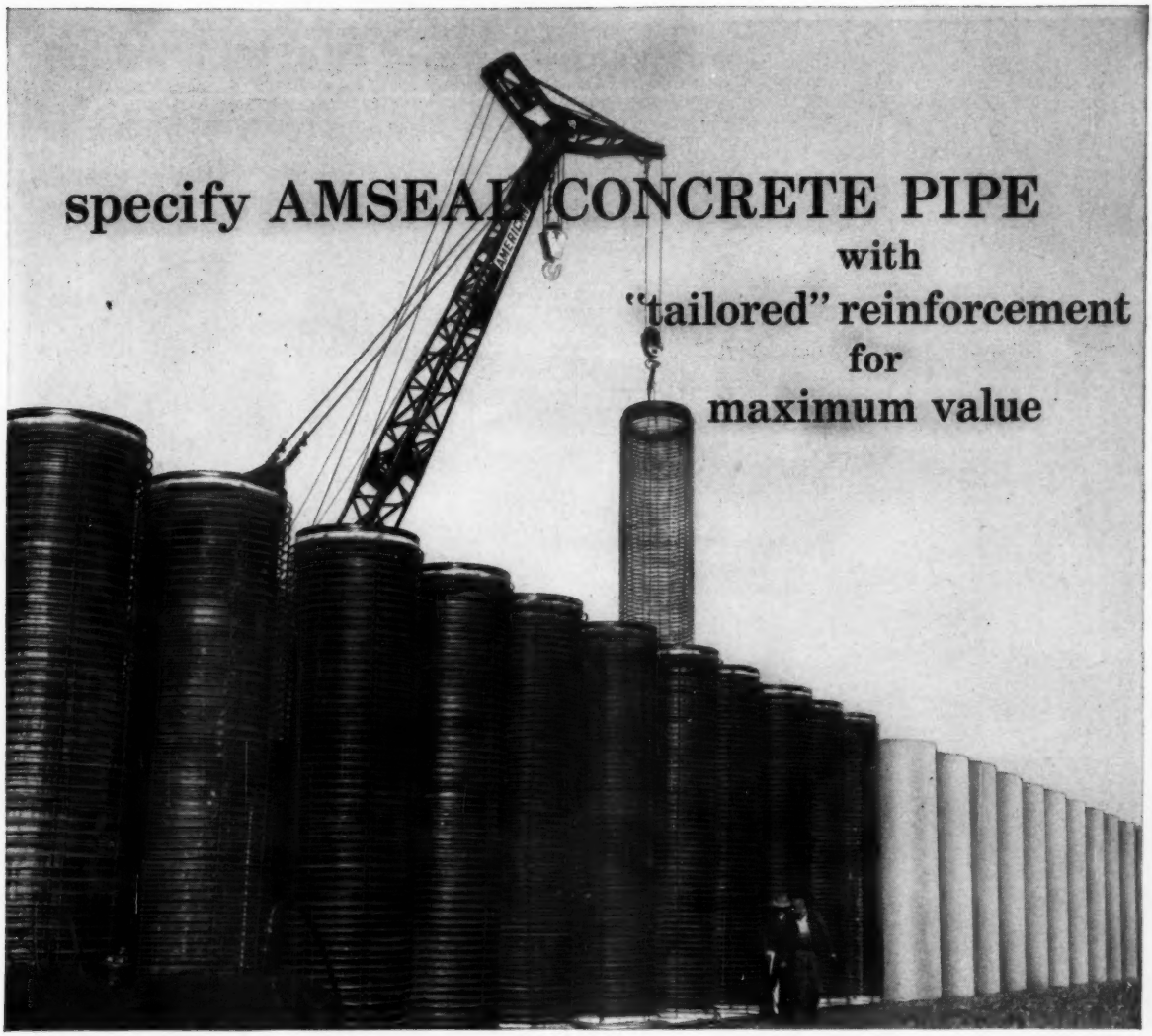
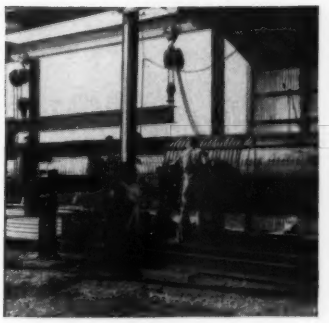


another example of

PROGRESS IN CONCRETE



The vital steel "backbone" of concrete pipe is a large part of its cost. Savings are possible with AMSEAL because its reinforcing is custom designed for each specific job. Precision machines make full length "cages" by winding steel spirally with effective control of diameter and spacing. A rigid backbone structure is formed by welding properly positioned longitudinal steel rods to the spirals.

The widely-used AMSEAL rubber and steel joint can mean freedom from worry about leakage or infiltration. Long 16-foot lengths mean less joints and faster installation.

Specify AMSEAL Concrete Pipe for life-long economies on your job.

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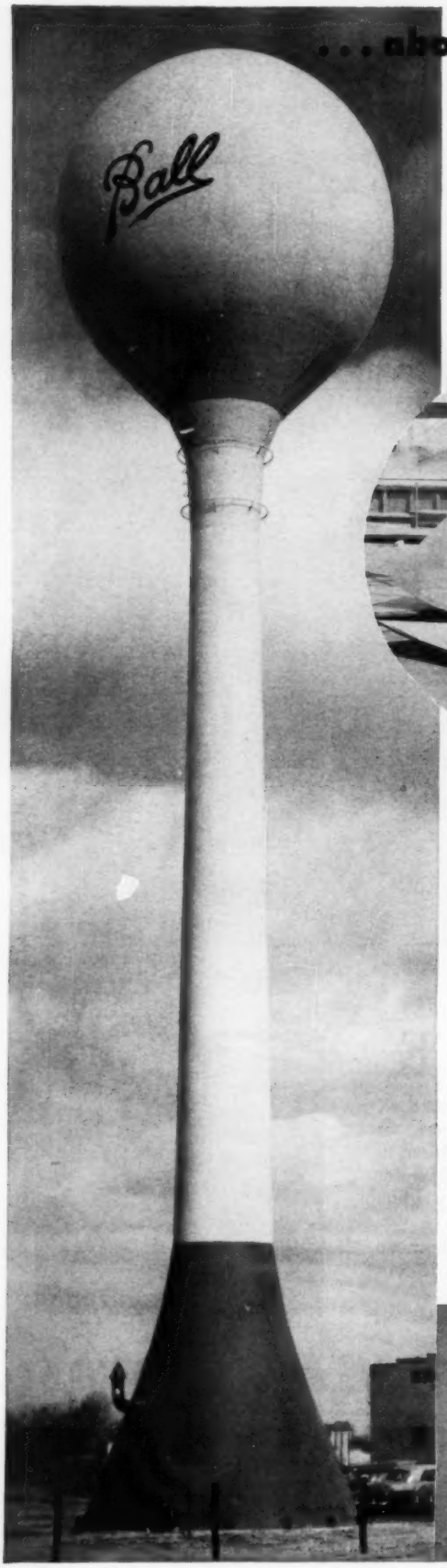
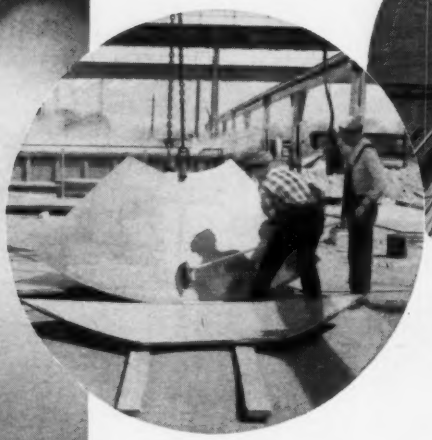
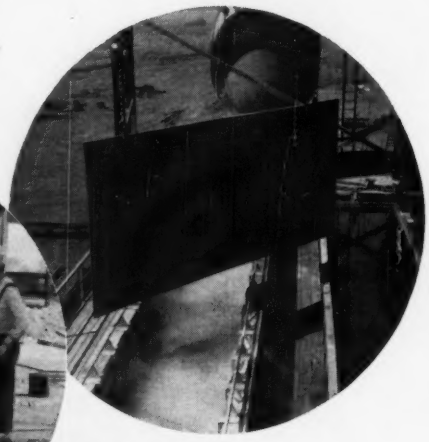


. . . about Weather and WATERSPHERES

How CB&I pickling process promotes beauty and protection for steel plate structures.

Plate coming from sulphuric acid bath where mill scale was removed. ▶





◀ Plates receive special prime coat while steel is still warm.

The Horton® Pickling Process is an efficient, economical means of removing mill scale from steel. It serves to eliminate the "human element" in the process of cleaning steel prior to painting and provides a clean dry surface, with an iron phosphate coating, which improves the bond between paint and steel.

A thorough manufacturing-type operation, the process consists of immersing the material in a hot sulphuric acid solution, then a wash water bath—followed by a hot phosphoric acid bath. Special priming paint is applied immediately after pickling . . . while metal is still warm to insure better bond.

Facilities for pickling and painting are now maintained at all of our four, strategically located plants. Write for information on how this efficient service can help extend the life and reduce the maintenance on *your* next CB&I structure.

◀ This 100,000-gal. Horton Watersphere® was pickled and painted before shipment to Ball Bros., Hillsboro, Illinois, nationally known manufacturer of glass jars.

CB&I

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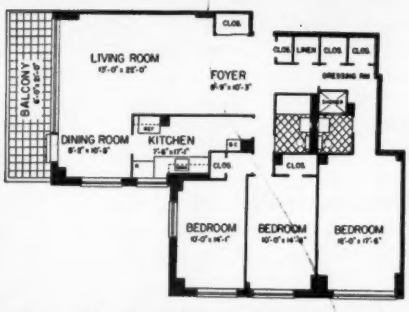
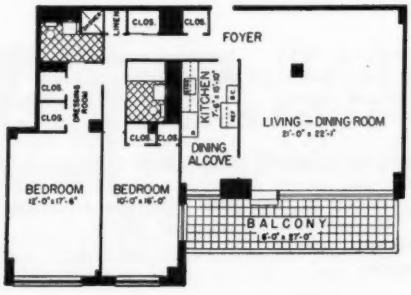


The floor plan above shows a typical three-bedroom apartment in Highpoint. The floor plan below shows a typical two-bedroom apartment. Owner and builder of Highpoint: Charles Kibel; architect: Henry Kibel; engineer: Greenhut & Taffel. All are from New York City.



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Here is reinforced concrete frame and floor construction adapted to a modern apartment house—Highpoint—in New York City. Its 16 floors provide 126 apartments and a penthouse. A 130-car garage is adjacent. A unique feature is the cantilevered floors at either end of the building to provide outside balconies.

There are many reasons for the growing popularity of concrete frame and floor construction. It offers great strength, unusual durability, firesafety and economy. Its moderate first cost, low maintenance cost and long life add up to ***low annual cost,*** which pleases owners and investors. And competitive bids show that this method saves up to 40% on frame and floor cost.

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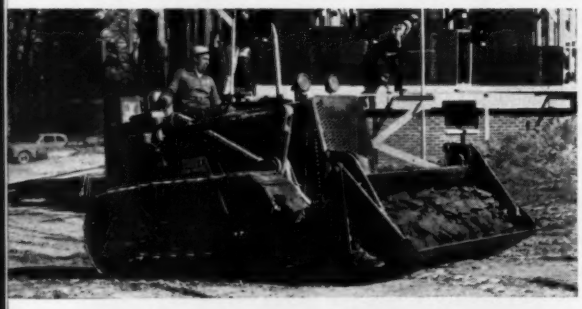
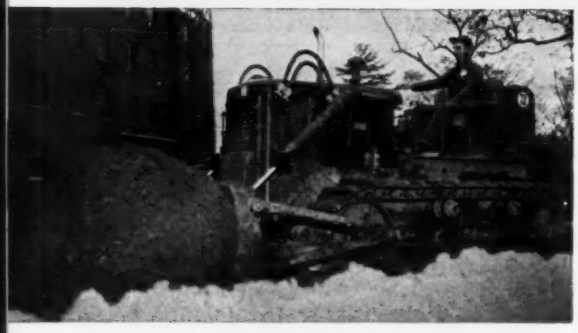
On any-size dirt job, anywhere... power-up profitably with



In the 200-acre Knollton Heights Subdivision, Hughy Construction Company, Indianapolis, stays ahead of the lot-grading with this TD-9 Four-In-One. Here, they're getting inch-close grading accuracy—boiling in dirt with Four-In-One "carry-type scraper" action! Excavating, loading, dozing, or clamshell action is instantly available with a Four-In-One!



"Our bread-and-butter machines are International Crawlers," says Perry Alexander, Jr., for Perry Alexander Construction Co., Asheville, N. C. "I just traded in a TD-18A, with 13,000 hours on its meter; used no oil between changes—and beat a competitive crawler in overall maintenance and track life." Picture shows their new TD-14 finish-grading around Asheville's new $600,000 Doctor's Building.

See how the bonus-powered International TD-18, for example, helps speed construction of "decentralized" new factories. You get cleared-for-action deck, control-tower visibility and booster steering to cut lever-pull effort. You also get operating ease of engine clutch with long-lasting Cerametallic facings. Such exclusive *feature combinations* help operators increase daily production, substantially!

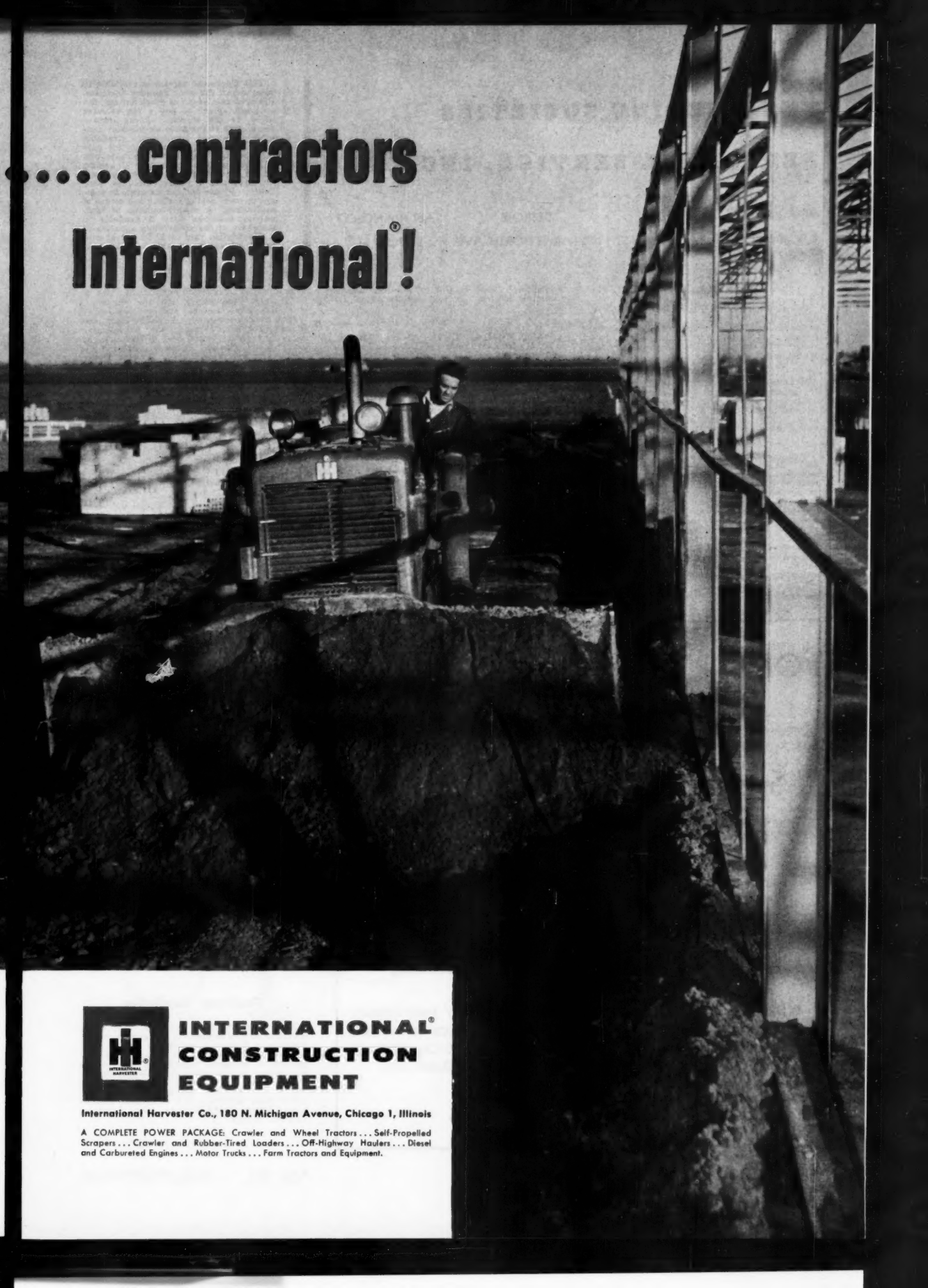
For your king-sized jobs, check these *giant-sized* advantages of the *giant-powered* TD-24. See how exclusive, time-proved Planet Power steering gives you full-time "live" power and traction on both tracks for positive, full-load steering, upgrade or down! Plus cycle-speeding on-the-go shifting—*and* instant, stall-preventing Hi-Lo shifting, without declutching!

For dirt-moving versatility, International Drott® Four-In-One Skid-Shovels® give you huge performance and production advantages over anything else in the loader-excavator field! You get instant, fingertip availability of *four* big-capacity machine actions: famous Skid-Shovel dig-ability; scraper-like grade-or-spread ability; earth-rolling bulldozer; and load-gulping, high-dumping clamshell!

Along with the superhighways are other millions of cubic yards of "big-pay dirt" to be moved in plant, school, public building, shopping center, and housing developments. *Prove to yourself* the reasons why more and more contractors are using International crawlers as their *power packages*. See your International construction equipment distributor for a demonstration.

"One of our TD-24's—a 1951 model—ran 7,500 hours before major overhaul on rails and engine," states P. H. Morris, for Morris Enterprises, Owensboro, Ky. "It's still in use with original rollers and sprockets. That sold me on TD-24's for my operation." This Morris-owned TD-24 moves 50% of the 45-foot earth-shale-soapstone overburden, ahead of the 3½-yard dragline.

Industry comes to Marked Tree, Arkansas—(population 3,000)—as a modern shirt factory rises on money locally-subscribed to create jobs. And local contractor, St. Francis Valley Construction Co., gets a profitable 8,000-yd fill-spreading job done on time with their hydraulic 'dozer-equipped TD-18!



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This placement service is available to members of the Four Founder Societies. If placed as a result of these listings, the applicant agrees to pay a fee at rates listed by the service. These rates—established to maintain an efficient nonprofit personnel service—are available upon request. The same rule for payment of fees applies to registrants who advertise in these columns. All replies should be addressed to the key numbers indicated and mailed to the New York Office. Please enclose six cents in postage to cover cost of mailing and return of application. A weekly bulletin of engineering positions open is available to members of the cooperating societies at a subscription rate of $3.50 per quarter or $12 per annum, payable in advance.

Men Available

PROJECT ENGINEER OR PROJECT MANAGER, A. M. ASCE; B.S. C.E.; 42; 6 years as such with general contractor on commercial and industrial projects to $5,000,000; 11 years' design and supervision with consulting civil engineers. Prefers West Coast. C-199.

MANAGEMENT ENGINEER, J. M. ASCE; B.S.C.E.; 35; general manager of small manufacturer of metal products, 5 years; erecting engineer, bulk material process plants, 2 years; designer-draftsman, building steel and machinery layout, one year. Prefers East or South. C-200.

CIVIL-AGRICULTURAL ENGINEER, A. M. ASCE; C.E., California Institute of Technology; 45; registered C.E. in California; completing contract as Senior Irrigation Engineer for Ministry of Agriculture, Saudi Arabia; 17 years' experience with Soil Conservation Service in southern California on soil and water conservation, irrigation and flood control; consulting engineer on structural design, surveying and flood control; holder of two patents; engineering teaching experience; member ASCE, ASAE, AGU; Past President local branch ASCE. Available September for responsible position in teaching irrigation and related civil engineering subjects, or in water management, flood control or research. Desires California location but will consider others. C-201.

JUNIOR ENGINEER, J. M. ASCE; B.S.C.E., 1955; 24; for past 2 years with USAF as installation engineer; seeks opportunity to obtain best possible experience leading to a P. E. license. Available September, 1957. Location immaterial, however not interested in Chicago or New York area. C-202.

STRUCTURAL DESIGNER, J. M. ASCE; B.C.E.; 24; one year and a half of structural design and drafting of foundations, building components, pressure vessels and tanks. Presently in Bolivia. Desires to locate anywhere in the United States or overseas. C-203.

CIVIL ENGINEER, M. ASCE; M.S. in C.E., M.I.T.; 39; 15 years regular Army Officer, Corps of Engineers, with experience in research and development, construction and high level military staff. Directly responsible for design work on air bases and military facilities of about $75,000,000 construction cost. Excellent Army record. Leaving Army due to large family, 5 children. Desires to locate in United States, preferably East coast. C-204.

HIGHWAY OR TRAFFIC ENGINEER, M. ASCE; B.C.E.; 72; land survey and city engineer 6 years; railway location and construction, 2 years; drainage engineer, 1 year; Philippines District Engineer, 5 years; railroad valuation engineer, 1 year; district and division engineer and research engineer, 35 years; senior traffic engineer for consulting engineer, 3 years. Desires location in South or West. C-205.

CIVIL AND SANITARY ENGINEER, A.M. ASCE; B.S.C.E. in 1938, M.S.C.E. in 1948, graduate work in sanitary engineering 1950; 4 years' general construction experience; 8 years Officer in Corps of Engineers; 7 years' experience teaching civil and sanitary engineering; 4 years' sanitary engineering design and construction supervision. Languages: Spanish and French. Available after May 1, 1957. Location desired: Rocky Mountains, Great Lakes, New England or Pacific Coast. C-206.

EXECUTIVE OR GENERAL MANAGER, M. ASCE; M.S. in C.E.; 40; 20 years' experience, as executive and head of engineering and construction organizations. This includes 5 years in Corps of Engineer District, 2 as District Engineer. Location desired: South or Southwest. C-207-Detroit.

CONSTRUCTION ENGINEER, J. M. ASCE; B.S.C.E.; 26; one year of design experience, concrete and steel; 2 years' experience in structural steel including detailing, quantity take off for estimates, field erection planning and supervision. General education background in addition to engineering. Desires position with general contractor, structures. Location desired: northern California; will consider other on West Coast. C-208.

CIVIL ENGINEER, J. M. ASCE; B.S.C.E.; 36; approximately 4 years in municipal and sanitary engineering; approximately 4 years in heavy construction. Some experience in concrete, soils and foundations. Desires employment in construction field. Available June 30, 1957. No preference as to location. C-209-San Francisco.

EXECUTIVE, M. ASCE; 54; with 30 years' experience in Latin America now having full responsibility $20,000,000 corporation with 2500 employees; administrative knowledge of law, accounting, mechanical, transportation, agriculture, finance, public and labor relations. Will consider post as responsible head of suitable enterprise anywhere. Available six months to one year. C-210.

MUNICIPAL ENGINEER, J. M. ASCE; B.C.E.; 26; 5 years' progressively responsible experience, layout, estimating, contract administration, personnel administration, budgeting, plant maintenance, scheduling, road construction; military service completed; supervised preparation of contract drawings and specifications. Location desired: East. C-211.

Positions Available

CIVIL ENGINEER, 25-30, graduate, with either structural or civil engineering background, with a minimum of 6 years in engineering work, 2 years of which must have been in design. Design experience in industrial construction and of the type gained in consulting work. Work will include design of foundations and structures for marine and dockside facilities, industrial and power plant buildings, and equipment foundations. Salary, $6,000-$8,400 a year. Location: Virginia. W-4502.

(Continued on page 126)

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(Continued from page 124)

INSTRUCTOR, graduate civil, for duties including lecturing, laboratory supervision and also assisting for three weeks at surveying camp; subjects of instruction are first year engineering drawing, a second-year course in surveying, and a course in materials of construction. Previous teaching experience not essential. Write giving full details of training and experience. Temporary, from August 1957 to mid May 1958. Salary, for this period, $4,450. Location: Canada. W-4507.

CIVIL ENGINEERS, young, with from 2 to 10 years' experience in heavy construction, for work on a dam project. Work will consist of material and quantity take-off, some drafting, field inspection of embedded materials, labor and equipment field recording for cost analysis and construction progress reporting. Salaries open. Location: New York State. W-4538.

SENIOR PROJECT DESIGNER, civil graduate, with at least 5 years' reinforced concrete experience covering concrete pipe, storage tanks and heavy construction. Salary, $8,000-$10,000 a year. Location: New York, N. Y. W-4550.

EDITOR, civil engineering graduate, with technical writing, editing and general publishing experience covering construction, materials and equipment. Some travel. Salary, $8,000-$10,000 a year. Location: New York, N. Y. W-4690.

CIVIL ENGINEERS. (*a*) Senior Bridge Design Engineer, graduate, with at least 8 years' experience in professional or administrative engineering. Thorough knowledge of principles of engineering practices and methods applicable to highway bridge location, design, construction and maintenance; modern bridge construction methods. (*b*) Highway Designer, graduate, with at least 4 years' experience in minor moderately difficult engineering work. Thorough knowledge of drafting principles, surveying and engineering sciences as related to highway design; principles of rural and urban highway design, including divided roadways and street developments; traffic requirements to highway design. Salaries open. Location: West. W-4696.

CIVIL ENGINEERS, (*a*) Senior Highway Location Engineer, graduate, with at least 8 years' experience in professional or administrative engineering. Should have thorough knowledge of principles of engineering practices and methods applicable to highway location, design, construction, and maintenance; modern highway construction methods; surveying, including public land surveys, U.S.C. and G.S. surveys, and U.S.G.S. surveys; drainage, material and construction costs, etc. Under direction, will be in responsible charge of planning, designing and construction engineering projects. (*b*) Engineer of Materials, graduate, with at least 8 years' experience in professional or administrative engineering. Thorough knowledge of principles of engineering practices and methods applicable to highway materials sources, selection, testing and uses; modern highway construction methods in the use of materials application of load requirements to pavement and subgrade design. Salaries open. Location: West. W-4697.

FIELD ENGINEER for large type airport terminal building, with at least 5 years' experience in similar work, for field and office engineering at responsible level, layout, estimating, material take off and procurement, change orders, cost records, etc. Knowledge of Spanish and Latin American experience particularly desirable. Salary, $7,000-$10,000 a year, depending upon qualifications, plus living allowance, travel, paid vacation and group insurance plans. Location: South America. F-4702.

PROJECT MANAGER-GENERAL SUPERINTENDENT for large monumental type structures, to assume complete responsibility of all phases of project, including construction, business management and engineering. Should have at least 5 years at top management level. Overseas experience, preferably Latin American, highly desirable. Knowledge of Spanish desired. Salary, $15,000-$18,000 a year, plus living allowance, travel, group insurance and other benefits. Location: South America. F-4706.

SENIOR CONSULTING ENGINEER, graduate civil, with 15 years' experience in construction and maintenance of highways. Must be a good organizer. Location: Washington, D. C. W-4711.

ENGINEERS. (*a*) Highway Engineer, graduate civil, with 5 to 10 years' experience on construction and maintenance of highways, particularly asphalt paving. Location: Nicaragua. (*b*) Railroad Engineer, graduate civil, with managerial experience in the construction and operation of a railroad. Location: Ecuador. (*c*) General Manager with considerable experience as a transportation economist. Location: Ecuador. Salaries, $15,000-$20,000 a year. F-4712.

SANITARY ENGINEER, must be responsible designer, capable of taking charge of design of small water and sewage treatment plants. Location: Ohio. W-4746-D.

ENGINEERS. (*a*) Sanitary Engineer experienced in the design of sewage treatment works; would also be required to work on water treatment plants and other projects in the water and sewerage fields. Salary open. Location: upstate New York. (*b*) Engineer's Assistant for the layout and inspection of sewer construction. Salary open. Location: vicinity of Poughkeepsie, N. Y. W-4747.

CIVIL ENGINEERS interested in hydrological and hydraulic investigations for flood control and allied projects. Experience desirable but not essential. Salaries open. Location: Ohio. D-3733.

DESIGNER-STRUCTURAL AND CIVIL, graduate or equivalent, 50-60, to take charge of 10 or 12 men squads, basically highway, some bridge, military structures, drainage, hangar structures, grade, pavement, minor housing, for an engineer consultant. Salary $8,400-$9,600 a year. Employer will discuss payment of placement fee. Location: West. S-2706.

SALES ENGINEERS, 24-30, civil graduates, with concrete experience, for technical field work with customers of cement manufacturer. Salary, $4,800-$6,000 a year, plus expenses and company car. Location: Northeast. W-4600.

CIVIL ENGINEERS for building contractors. (*a*) Graduate Civil, 27-37, with experience in estimating, operations and sales for immediate estimating operations position with some sales responsibilities leading to later full time sales position and eventually to considerable responsibility for management of company sales program. (*b*) Graduate civil, for position as estimator and assistant to project manager. Experience may be limited. (*c*) Graduate civil, young, with experience in layout of multi-story reinforced concrete frames for position as field engineer leading to later opportunity as superintendent or office engineer. Location: New York, N. Y. W-4628.

DEAN of ENGINEERING who is interested in developing school and has a strong bent toward administration. Salary dependent upon education and experience. Location: South. W-4634.

CIVIL ENGINEER, graduate, 30-40, for long-established engineering organization. Experience in highway and municipal fields or concrete structural design is necessary. Reply by letter giving résumé of education, engineering experience, and salary requirement. Location: New York State. W-4635.

FIELD ENGINEERS, three, preferably under 30, graduate civil or architectural, preferably with a major in structural design; with from none to a few years' experience; must be qualified to understand problems of design in structural steel; be interested in promotional work and able to present subject well. Salary open, plus fringe benefits. Company will pay placement fees, and relocation expenses. Location: one for Philadelphia, Pa., one for Chicago, Ill., and one for Los Angeles, California. W-4636.

ENGINEERS. (*b*) Construction Superintendent, graduate, with 12 to 15 years' experience, at least 3 as head of construction project in industrial or chemical plants. Coordinate work of prime and subcontractors, schedules, materials and equipment, etc. (*c*) Senior Construction Engineer, with 8 to 10 years' experience on construction of industrial or chemical plants, to assist superintendent or to assume full charge on small projects. (*d*) Construction Engineer, graduate, with 5 to 8 years' experience, to assist superintendent and senior construction engineer in reviewing design drawings and specifications, proposals, construction schedules, etc. (*e*) Assistant Construction Engineer, with 3 to 5 years' ex-

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HYDRO PROJECTS
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Will consider lesser experience with good educational background. Several recent graduates will be added to our structural staffs to round out this planned expansion program. Occasional openings for combination men in construction supervision and inspection; must be free to move and to assume office duties between assignments.

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perience on industrial construction projects, to follow progress in the field, inspect work of contractors, etc. Salaries open. Locations: Base, New York State; other locations throughout United States. W-4663.

CIVIL ENGINEER, with 10 to 15 years' experience, 5 years of which should have been in the design of structures, both steel and reinforced concrete, mill and laboratory buildings, etc. Salary open. Location: base, New York State; others throughout the United States. W-4664(*b*).

HIGHWAY AND BRIDGE DESIGNERS, young, for extensive highway project. Some experience desirable. Salary, plus profit sharing, plus fringe benefits. Location: Michigan. W-4672.

INSTRUCTOR for department of civil engineering; master's degree preferred but will consider a graduating senior with an outstanding record and with an interest in teaching. Applied mechanics and strength of materials are taught as well as the courses in civil engineering. Appointment for fall semester 1957. Salary, $4,500-$5,400 a year. Location: Midwest. W-4676.

Positions Announced

City of New York. Openings exist for Civil Engineers (Water Supply) with the Board of Water Supply. The salary range is $7,100 to $8,900 a year. Appplicants must have a B.S. degree in civil engineering and six years satisfactory experience in design or construction work related to water supply works and structures, or be high school graduates with ten years of experience. Civil engineers (water supply) are eligible for promotion to Senior Civil Engineer with a salary range of $9,000 to $11,100 a year. For full information contact Arnold de Mille, Director of Recruitment, City of New York, Department of Personnel, 299 Broadway, New York, before April 22.

U. S. Civil Service. McClellan Air Force Base, California, has openings for civil, materials and general engineers, under the classification GS-5 and 7, with salary range from $4,480 to $5,335 a year. Applicants must show completion of a full four-year or longer accredited engineering curriculum, leading to a bachelor's degree, or other professional engineering curriculum equivalent in type, scope and quality. Standard Form 57 is obtainable from local post offices or from U. S. Civil Service Examiners, Sacramento Air Material Area, McClellan Air Force Base, California.

Army Corps of Engineers. There are several openings for engineers at the U. S. Army Engineer Center, Fort Belvoir, Va., under the classification Engineer (Bridge) GS-7, 9, 11 salary from $5,335 to $7,035 per year, and Engineer (Civil) GS-5, 7, 11, salary from $4,480 to $7,035. Obtain application Standard Form 57, from any Civil Service or Department of the Army Civilian Personnel Office, fill out, and mail to Civilian Personnel Office, Employment Division, Room 200A, Building 211, 21st Street, U. S. Army Engineer Center, Fort Belvoir, Va.

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Benefits include salary schedule, sick leave with pay, paid vacations, military leave with pay, available hospitalization plan.

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Please give detailed personal and experience record, competent references and salary expected in first letter.

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New Publications

(Continued from page 110)

Welded bridges . . . To keep pace with the increasing use of welding for new bridge construction and for strengthening and repair work, the American Welding Society has made available a fifth edition of its "Standard Specifications for Welded Highway and Railway Bridges." One important addition to the new edition is provision for the use of a steel especially suitable for welded bridge construction. Design and workmanship requirements for submerged arc welding are other important additions. Copies, priced at $1.50 each, may be purchased from the American Welding Society, 33 West 39th St., New York 18, N. Y.

Swamp stabilization . . . Problems involved in constructing road embankment in marshy or swampy terrain are thoroughly discussed in Technical Report No. 8 of the Johns Hopkins University Department of Civil Engineering. Tests on the vertical sand drain are included in the study, which was conducted at Johns Hopkins under a research contract sponsored by the Maryland State Roads Commission. Walter C. Boyer, Edmund G. Hart, and Robert L. Kondner are authors of the report. Inquiries should be sent to the Johns Hopkins University, Department of Civil Engineering, Baltimore, Md.

Waste water reclamation . . . Continuing studies of reclamation and utilization of waste waters—conducted at the Sanitary Engineering Research Laboratory of the University of Southern California—have been released by the California State Water Pollution Control Board. Two principal studies are described in this second report, identified as State Board Publication No. 15. One concerns reclamation of liquid digested sludge in San Diego County for the dual purpose of enriching waste lands and lessening the pollution of San Diego Bay. The other—concerned with the reclamation of raw sewage lagoon effluent at Mojave, Calif.—is intended to provide economical irrigation water for a marine airbase while demonstrating the adequacy of the raw sewage lagoon as a means of sewage treatment for the small desert community. Single reference copies are being supplied to government officials and agencies directly concerned with pollution control. Others may purchase copies from the State Printing Division, Documents Section, Sacramento 14, Calif., at a cost of $1.45 a copy, which includes postage but not the 6-cent California sales tax.

Contracting, Great Britain . . . The part played by British contractors in the ever-expanding construction industry of the country is told for the first time in an illustrated survey, entitled "The British Civil Engineering Contracting Industry." The volume, which covers a 200-year span, stresses the "creative partnership between engineer and contractor" that has made possible the major projects treated. Inquiries should be addressed to the Federation of Civil Engineering Contractors, Romney House, Tufton St., Westminster, S.W. 1, England. The price is £3,35.

Engineering registration . . . Availability of a new enlarged and revised compilation of examinations given by the State of California for the registration of civil engineers and engineers-in-training is announced by the author, August E. Waegemann, 2833 Webster St., San Francisco 23. For the examinations between 1940 and July 1949 there are the author's unofficial solutions to problems, and from the latter date through June 1956 the problems only are given. Copies may be obtained postpaid from Mr. Waegemann for $7.00 plus tax, or they will be sent on request, C.O.D., plus postage.

Hot-mix asphalt paving . . . A 168-page pocket-size manual, published by the Asphalt Institute, provides instruction on the design of mixes by the Marshall, Hveem, Hubbard-Field, and Smith Triaxial test methods. Appendixes include information on the gradation analysis of aggregates and the density and voids analysis of compacted paving mixtures. The price is $1.00, and checks should be sent to the Asphalt Institute, College Park, Md.

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2 AERIAL MAPPING

Aero Service Corporation—Literature covering new and more economical applications of varied aerial mapping services is offered. These include aerial photography, topographic and planimetric maps from an aerial photographic base, precise aerial mosaics, and plastic relief maps. Services discussed are used in highway design, plant engineering, industrial development, city planning.

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3 AERIAL SURVEYS

Alster & Associates, Inc.—Latest information on aerial surveys is offered in a booklet "Topographic Mapping From Aerial Photography." Fully illustrated, this booklet describes how maps are made from aerial photographs and analyzes uses and advantages of the topographic, planimetric and mosaic maps the firm produces. Explains how the photogrammetric method reduces survey costs as much as 75% compared to conventional ground survey methods.

4 AERIAL SURVEYS FILMS

Hycon Aerial Surveys, Inc.—A 24-min motion picture in natural color titled, "Portrait of the Earth". This film illustrates the application of aerial surveys to photographic and topographic mapping problems of the civil engineer, the geologist, and the geophysicist. In addition, a 24-min motion picture in color titled, "The Other Side of the Mountain". This film illustrates the application of reconnaissance and precision photogrammetric equipment in various military and commercial mapping problems.

5 AIR-ENTRAINED CONCRETE

Lone Star Cement Corp.—A 36-page booklet, illustrated with 11 graphs and tables and 86 photographs, contains technical and practical information as to desirable air content, increased durability and resistance to frost action, improved workability, reduced bleeding and easier finishing of concretes made with Lone Star air-entraining Portland cement and "Incor" air-entraining high early strength Portland cement. Of special value is definite information for use in designing air-entrained concrete mixes.

6 ALUMINUM GRATING

Kerrigan Iron Works, Inc.—A 4-page brochure of engineering data and a safe load table on spark-proof Kerrigan Weldforged aluminum grating-open flooring, and stair treads is offered. Light weight, non-magnetic, noncorrosive, this grating has no maintenance cost and its high strength insures many years of service. It is now manufactured in types and sizes of grating for every need; steel, stainless, monel, aluminum, riveted, extra close spaced and serrated.

7 ASPHALT HANDBOOK

The Asphalt Institute—This 304-page manual, Construction Series 81, is the primer for all personnel engaged in asphalt construction. Among the subjects covered are: Uses of Asphalt; Tests; Paving Equipment; Design, Manufacture and Inspection of Plant Mixes; Design of Asphalt Pavements for Highways, and Airports; Asphalt Useful Tables; Specialty Uses; and Maintenance and Resurfacing. Price $1.50.

N. B. There is a charge for this book. Make checks payable to The Asphalt Institute.

8 ASPHALT PLANT

Madsen Works—Catalog No. 20-S illustrates and describes the 2000-lb. SPECIAL Asphalt Plant. The plant is rated at 60 tons per hour, yet consistently produces in excess of 80 tons per hour. It is a portable plant, ideal for the not-too-large contractor, the municipality, and the large asphalt producer who has in mind a small permanent operation for producing about 480 tons per day.

9 ASPHALT PLANT

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10 ASPHALT PLANT

Madsen Works—Bulletin No. 391 illustrates and describes the new Model 391 Hot Rod Asphalt Plant. This plant is available in 3000-lb, 4000-lb, and 5000-lb capacities. This outstanding portable batch type asphalt plant features simple, streamlined design, fully enclosed gear box reduction unit, automatic operation (available as optional equipment), Twin-Shaft Pug Mill Mixer and many other engineered advancements.

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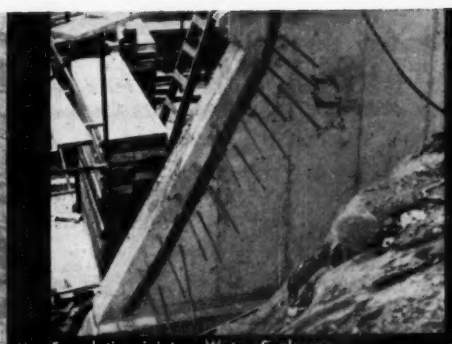

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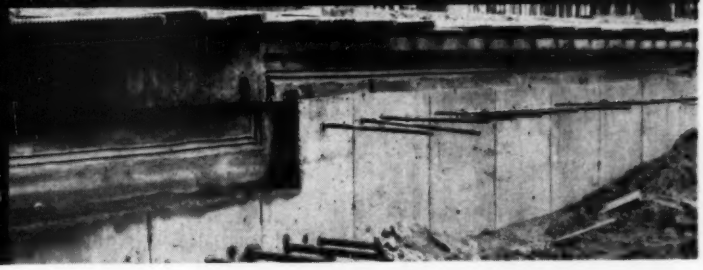

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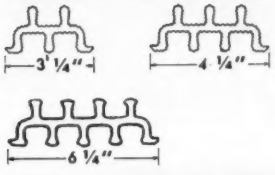

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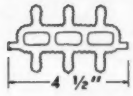

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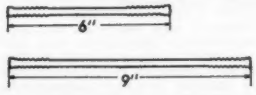

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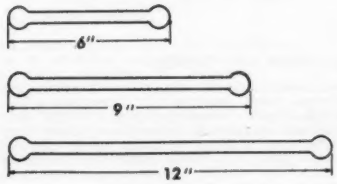

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11 AUGER DRILLS

The Salem Tool Company—Earth and rock boring auger drills are described in Bulletin M-105. Features of horizontal blast hole drills are explained, as are the following features of truck-mounted and self-propelled drills: power unit, transmission, main drive case, carriage, main frame, hydraulic unit and elevating jacks.

12 AUTOMATIC COUPLERS

Mayo Tunnel & Mine Equipment—A simple and economical automatic coupler for small mine cars is described in a recent brochure. In addition, side-dump cars, rocker-dump cars, car passers, pneumatic grouters, and muck bins are explained and illustrated.

13 AUTOMATIC GATES

Thompson Pipe & Steel Co.—Catalog B-37A illustrates and explains in detail the three devices which control water levels and flow without supervision. On-the-job photos give a clear picture of the many uses of the automatic gates.

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14 AUTOMATIC VALVELESS FILTER

The Permutit Co.—Bulletin 4351 describes the company's new completely automatic gravity sand filter for municipal or industrial water treatment. Uses no valves, pumps or flow controllers. Costs less than conventional manual filters. Also reduces costs of installation, operation, maintenance and expansion. Produces uniform, high-quality effluent. Sizes to 400 gpm.

15 BATCHING PLANT

Noble Company—13 pages of widely illustrated photographs of the Mobile Batching Plant is contained in this colorful booklet. It describes the mobile plant in operation, supplying concrete for building construction jobs. Clear view of various equipment within the mobile plant. Also description of a new automatic Batcher, Clamshell Gate and Slide Gate.

16 BELT CONVEYORS

Link-Belt Company—Pre-Bilt sectional belt conveyors in standardized, pre-engineered units with capacities ranging up to 1,500 tons per hour are described in a new book. These conveyors incorporate standard Link-Belt components, including the new Series 50 idlers, packaged with sectional truss frames and structural steel supporting bents. They are built in 18, 24, 30, and 36-in. belt widths, with 24 and 42-in. deep trusses. Drives range up to 50 hp. More information is contained in the illustrated 8-page book 2579.

17 BITUMINOUS BATCH MIXING PLANTS

Barber-Greene Company—A bulletin of 12-pages describes and illustrates the revolutionary principles of Barber-Greene's 2000-4000 and 6000 lb "BatchOmatic" bituminous batch mixing plants. Plants feature fully automatic operation, simultaneous measuring of all aggregate and bitumen. "Dynamix" pugmill and many others are all diagrammed and illustrated with text and pictures.

18 BITUMINOUS MIX PLANT

Barber-Greene Co.—This 36-page catalog illustrates all of the components of the Model 848 series Asphalt Plants. Through illustrations and explanatory copy, the reader is shown how all of the basic plant components, including the mixer, dryer, gradation control unit and dust collector, plus a host of accessory feeders, elevators and other units, can be combined into four separate plant set-ups, with each designed specifically for a particular application.

19 BITUMINOUS MIX PLANT

Barber-Greene Co.—A new twelve-page folder describing Model 840-B continuous-mix asphalt plant, has just been announced. The Model 840-B plant, which is rated at 50 tph on cold mixes and 45 tph on intermediate and high type mixes where dried and heated aggregate is required, can be used in several set-ups and combinations of equipment. Thus, it is readily changed from one type of mix production to another.

20 BOILER AND STOKERS

The James Leffel & Company—Complete descriptive and specification information on rugged Scotch boilers for gas, oil and coal firing and automatic underfeed stokers for Scotch type boilers is given in a 28-page bulletin 236. This richly illustrated brochure includes test results, performance data, and complete details of design and construction.

CATALOG DIGESTS

21 BORINGS

Raymond Concrete Pile Co.—A booklet "Subsoil Investigations for Foundations" Catalog B-6 explains the reason for subsoil investigations, what Gow borings are and how they are made, and the results obtained. Illustrated are methods for making borings and taking samples, and various types of rigs in operation.

22 BRIDGE FLOORING

United Steel Fabricators, Inc.—A 12-page booklet on Structural-Plate Bridge Flooring includes a general description of the flooring, step-by-step installation photographs, photographs of various types of bridges for which it has been used, drawings of engineering details, design data, and specifications. Another section lists the types of plates available for field stocks, and suggestions on how to determine field stock requirements.

23 BRIDGE FLOORING

American Bridge Division—This 32-page booklet contains complete engineering drawings and design data for all available I-Beam-Lok sizes, plus detailed coverage of Specifications, including the type of steel, erection, fabrication, painting, field assembly and welding. A brief discussion of composite T-beam action between I-Beam-Lok flooring and steel stringers is also included.

24 BRIDGE REHABILITATION WITH CONCRETE

Intrusion-Prepakt, Inc.—New 12-page, profusely illustrated, technical bulletin provides basic information on the use and advantages of techniques for the restoration and strengthening of bridge piers, abutments and structural members. Bulletin includes two technical articles plus eight case histories showing before and after views of completed work using the Prepakt method. A list of other services, main and regional offices as well as foreign representatives are given.

25 BRUSH CUTTER

Dorsey Trailers—The Dorsey Brush Cutter is built tough for rough jobs. Advanced design, its special construction and its many advantages are discussed and illustrated by photos in a colorful brochure now available.

26 BUILDERS LEVEL

Kern Instruments Inc.—Now available a new brochure describing the GKO Builders Level. The booklet describes the new ideas incorporated into the design of this latest level. Special emphasis has been given to simplicity of operation, portability and ruggedness. The instrument should be of interest to all construction engineers, contractors and builders.

27 BUILDING SAVERS

L. Sonneborn Sons, Inc.—An eight-page brochure of building construction and maintenance data covering the company's waterproofings, floor treatments, admixtures and protective coatings. The product descriptions include definitions, directions, advantages, coverage and specifications. Known as Building Savers, these quality products are the tested solutions to your building construction and maintenance problems.

28 CARPULLERS

Superior-Lidgerwood-Mundy Corp.—A new 24 page, 2 color bulletin C-616 "Carpullers for Easy Moving Rolling Loads" has just been issued, with descriptions, illustrations, data, tables and specifications for Carpuller requirements. Illustrates and describes the Electric Capstan Carpuller for car moving, barge moving, pipe bending or any haulage of similar nature; also Tugmore Capstans, Horizontal Head type Capstan Carpullers, Drum Type Carpullers, Friction Drum Type Carpullers, etc.

29 CAST IRON PIPE

U. S. Pipe & Foundry Co.—An 8-page booklet on centrifugally cast, Tyton Joint pipe for water or other liquids. The newly developed Tyton Joint is simple, sturdy, and tight. Illustrations show details of joint and method of assembly.

30 CAST IRON PIPE, HYDRANTS AND VALVES

R. D. Wood Company—A new general catalog has recently been issued providing full details of weights and dimensions of "sand spun" cast iron pipe and cast iron fittings. This catalog also features fire hydrants, gate valves and other products manufactured by this company.

RETURN THE COUPON

TODAY FOR IMMEDIATE

RESULTS!

31 CEMENT MORTAR LINING

Pipe Linings, Inc.—Complete facilities for cement mortar lining cast iron or steel pipelines "in place" from 4-in. to 144-in. in diameter, both the Tate Process and Centriline Process is offered. For full information on cleaning and cement mortar lining pipe with only momentary interruption of service, write for catalog.

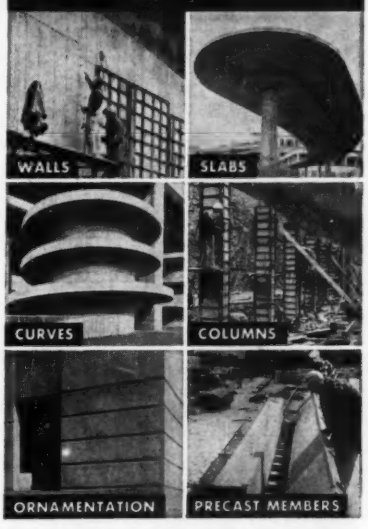
32 CENTRIFUGAL, TURBINE-TYPE PUMPS

Aurora Pump Div., The New York Air Brake Co.—The current line of Centrifugal and Turbine-Type Pumps is comprehensively presented in an eight page Condensed Catalog and Selection Guide. A unique selection table indicates which types of pump will meet certain capacity and head demands. Each pump is illustrated together with a statement of applications, features and individual selection tables. Bulletin identification references are provided where detailed information regarding given pump types is desired.

33 CHLORINATOR

Wallace and Tiernan, Inc.—Describing in complete detail the Series A-711 Chlorinator, and Series A-712, two catalogs offer excellent technical data about these chlorinators. Featuring a new concept in chlorine flow control, the V-natch Valuable-Orifice provides wide range of adjustment and good reproducibility of chlorine flow with substantially linear flow readings on a rotameter feed rate indicator.

BEST for ANY JOB!



FOR DESIGN ADAPTABILITY, no other material compares with fir plywood. Monolithic surfaces, curves, special effects are easily achieved with fir plywood. Large panels are easy to cut, fit and fasten. Plywood forms smoother concrete, cuts application, finishing time. Interior PlyForm® grade gives up to 10-12 re-uses; Exterior PlyForm® 25 or more; overlaid plywood about 200!

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Fir Plywood

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FREE: New portfolio to help you design and use fir plywood forms. Contains complete specification, construction and design data.

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Please send new Fir Plywood Concrete Form Portfolio. (Offer good USA only)

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WELDED *grating*

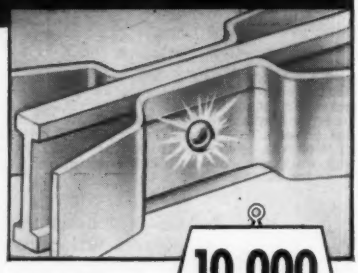
PAT. PENDING

Realizing the need for an improved heavy duty, open steel floor grating of greater strength and economy, The GLOBE Company presents GOLD NUGGET Welded Grating — the first grating to take advantage of modern engineering design. As a result of this improved design, the GOLD NUGGET primary load bar provides 22% more strength with 14% less weight. The primary load bar is a miniature I-beam with all of the advantages of a true structural member.

GOLD NUGGET Welded Grating is recommended for power houses, loading docks, oil refineries, fire escapes, drain grates, plating rooms, filtration rooms and for all types of heavy duty platforms.

GOLD NUGGET

- ★ 3/8" projection weld nugget for greater rigidity and strength
- ★ vertical alignment of the main load bars assured
- ★ all bars are load carrying bars including secondary bars
- ★ anti-skid pattern



PROJECTION WELD

Each secondary load bar (A), as projected welded to the primary load bar (B) has a shear strength of 5,000 pounds per weld. There are 28 such projection welds to a square foot of grating. This means that GOLD NUGGET Welded Grating can sustain greater shock loads than other gratings.

For the complete details of this revolutionary new grating, write for new catalog today. Distributors in all principal cities. Consult the yellow pages in your phone book under "GRATING."

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PRODUCTS DIVISION

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CATALOG DIGESTS

34 CLAY PRODUCTS

Evans Pipe Co.—Comprehensive, complete line catalog describes the complete line of clay building products. Fully illustrated, and indexed for quick reference, the catalog contains information about vitrified clay pipe, fittings, wall coping, flue lining, stove pipe and fittings, drain tile, chimney pots and tops, septic tanks, pre-cast asphalt joints, liner plates, fire brick, Tebco face brick, and clay pipe heating duct systems.

35 COAL RECOVERY DRILLS

The Salem Tool Company—Bulletin M-101, a four-page, two-color pamphlet describes coal recovery drills 16-in. to 42-in. in diameter for 6-in. augers. Photographed are a heavy-duty barrel-type drill head 42-in. in diameter with tungsten carbide 3-prong pilot adjustable core burster, reinforced double auger flighting, barrel equipped with bug dust clearance spirals; and a 36-in. heavy-duty nut and slack drill head for drilling rock and producing nut and slack coal.

36 COFAR STEEL FORM

Granco Steel Products Co.—New product manual, BC-571, gives comprehensive data on modern development in reinforced concrete floor systems. Cofar, a high-strength steel form and reinforcing unit, eliminates the time, material and money expended in costly form work. It provides speed and sureness in the design and construction of concrete floors by combining three remarkable features in one unique product.

37 COFFERDAMS

Spencer, White & Prentis, Inc.—"Cofferdams," by Lazarus White and Edmund Astley Prentis is a trusted source-book covering actual design and construction of cofferdams as well as the theoretical features. The price is $10.

N. B. There is a charge for this book. Make checks payable to Spencer, White & Prentis, Inc.

38 COILFILTER

Komline-Sanderson Engineering Corp.—Available bulletins on the Coilfilter, a modern vacuum filter, describe how this filter is designed for sludge dewatering requirements. Outstanding features of the filter are defined as non-clogging, permanent filter media, constant output and low operating cost.

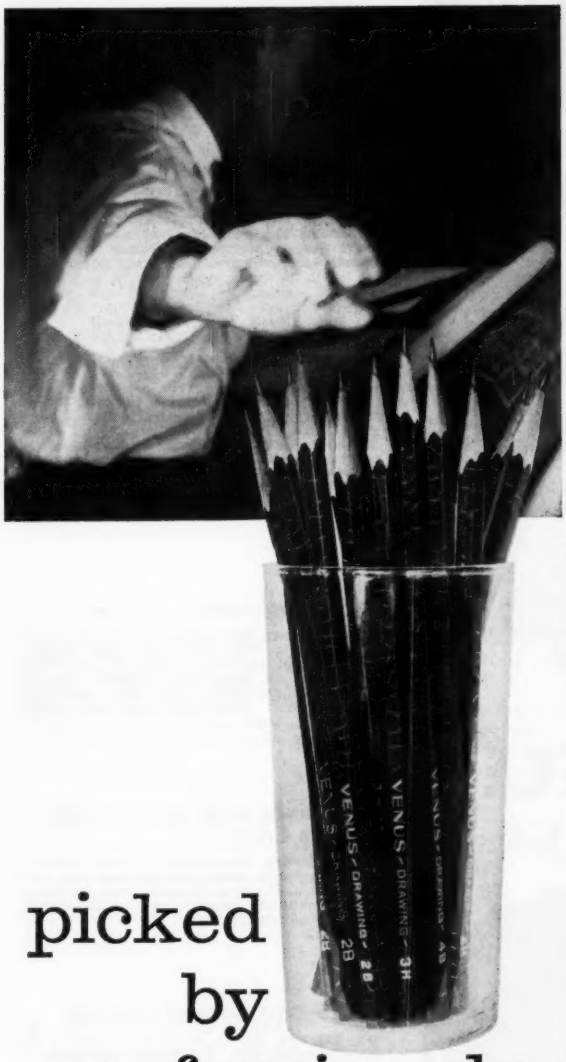
39 COLORED DRAFTING PENCILS

J. S. Staedtler, Inc.—An interesting leaflet "Why Are People Intrigued With Mars?" Contains information on the new Mars-Lumochrom colored drafting pencils which were designed with the needs of the draftsmen especially in mind. Reproduction is perfect throughout the entire 24 color range in which they are made so that they are well suited for drafting in color.

40 CONCRETE CURING COMPOUNDS

Hunt Process Co., Inc.—Facts about the Hunt Process curing are detailed in the booklet offered. A separate page is devoted to each of the four processes: Process Clear, Tilt-Up, Black and pigmented. Necessity and methods of concrete curing are discussed in full.

Turn to page 130 and order your literature.



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Reach for a Venus drawing pencil... and get the clearer, consistent, precision line blueprint and drafting work demands. The lead in all 17 degrees of Venus drawing pencils is homogenized by the exclusive Venus Colloidal Process. Result: sharper prints . . . smudge-free tracings. Clean erasures are easy to make.

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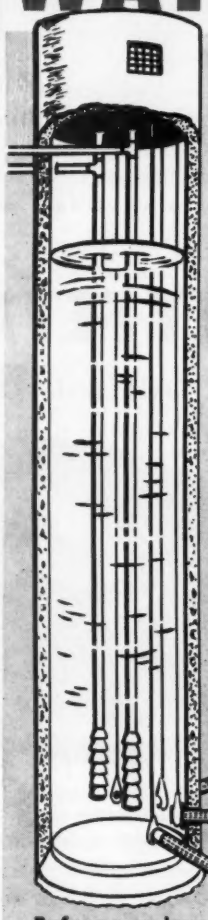

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ALBADURE*... the steel tape with lasting legibility

Here is a steel tape that stays clear and legible long after markings on other tapes have worn off.

An amazingly tough plastic coating on both sides of the line protects the white background, the graduations and numbers on ALBADURE tapes, giving their surfaces tremendous resistance to abrasion and corrosion. To quote a State surveying party report, "If ALBADURE stood up in this tough mud and sand, it'll stand up anywhere." Available in all standard lengths, widths and graduations, in cases and on reels.

PHOENIX WYTEFACE®... the woven tape that outlasts others 3-1

PHOENIX WYTEFACE (non-metallic) Woven Tapes made from extra strong synthetic yarns, are harder wearing, with higher tensile strength and dimensional stability than ordinary woven tapes. A special plastic coating on both sides protects the line against hard use, water, stones or brush.

The end of the line is enormously strengthened by a lamination of Flexi-Foam, a spongy plastic-rubber. No stitches or hinge point to weaken the line.

A Highway Engineer reported of the non-metallic PHOENIX WYTEFACE, "It has at least three times the life of an ordinary metallic tape." *Ask Your K & E Dealer!*

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89 YEARS OF LEADERSHIP In equipment and materials for drafting, surveying, reproduction and optical tooling . . . in slide rules and measuring tapes.

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CATALOG DIGESTS

41 CONCRETE FORMING ON SEWAGE PLANTS

Universal Form Clamp Co.—A 4-page bulletin points out the advantages of the Uni-Form Panel System in forming circular walls and Y walls on sewage treatment plant jobs.

42 CONCRETE FORMING SYSTEM

Economy Forms Corporation—A catalog with pictures is offered showing a complete forming system available to contractors on a purchase basis. The easy adaptability of these forms to all types of form work, plus engineering layout service on each new project, together with a complete steel form good for a lifetime of service makes the new EFCO form an attractive investment for the large and small builder.

43 CONCRETE FORMS

Universal Form Clamp Co.—A 32-page catalog points out to contractors the many features of Uni-Form Concrete Forms. It illustrates how forms are erected and stripped, gives a variety of applications and data explaining how Uni-Form Panels form concrete rapidly and economically.

44 CONCRETE FORM TIES, ACCESSORIES, ROAD BASKETS

Universal Form Clamp Co.—A 32-page catalog containing a complete line of form ties and concrete accessories. Catalog features form design table and formula for developing stud wale and tie spacings.

45 CONCRETE HANDLING EQUIPMENT

Gar-Bro Mfg. Co.—A profusely illustrated 36-page catalog 300, containing specifications for more than 300 items of concrete handling equipment is now available. Serving as a job conditions and specifications guide, it features concrete buckets, chutes and hoppers, bucket attachments, powered crane hooks, carts, wheelbarrows, bins and batchers, paving vibrators, industrial wheels and other equipment.

46 CONCRETE PAVEMENT MANUAL

Portland Cement Association—This 72-page illustrated manual gives details of geometric pavement designs and outlines the best methods of construction. It presents in summarized, usable form, data on pavement layout and construction from recent technical society proceedings, engineering publications, field observations, tests and experience.

(Sent in U. S. and Canada only.)

47 CONCRETE PIPE FOR IRRIGATION AND DRAINAGE

American Concrete Pipe Association—An official publication is available to engineers. It contains information on design of irrigation pipelines, construction of irrigation pipe lines, methods of irrigating with concrete pipe lines and descriptions of various irrigation projects. This book is priced at 70¢.

N. B. There is a charge for this book. Make checks payable to the American Concrete Pipe Association.

CATALOG DIGESTS

48 CONCRETE REPAIR

Masonry Resurf. & Cons. Co., Inc.—"Iron Girdle Holds Concrete for Bridge Pier Repair" is a reprint illustrating the methods and techniques of "in the dry" repair of a 24-ft dia pier near Baltimore, Md. These procedures which revitalize deteriorated structures adding many years of useful life to an old structure are similar to those utilized in the "Dri-Por" system of pile repair. Many illustrations clearly show the work in various stages of repair.

49 CONCRETE SAWING EQUIPMENT

Concut Sales, Inc.—New 4-page catalog illustrates and describes the complete line of Sawing Machines. Catalog also includes description of the new Precision Bump Cutter which is used to plane concrete and asphalt surfaces to comply with the close tolerances required for today's highways and airports.

50 CONCRETE SHORE PROTECTION

Portland Cement Association—Engineers and officials concerned with beach erosion control will be interested in an illustrated 30-page booklet on the use of concrete shore-protection structures. The booklet presents a discussion of wave action as well as other factors influencing the type and design.
(Sent in U. S. and Canada only.)

51 CONCRETE TEST EQUIPMENT

Soiltest, Inc.—A 6-page bulletin on portable 200,000-lb concrete testing machines designed for field or laboratory use. Other items illustrated and described are: Precision Air Entrainment Meter, Beam Forms, Cylinder Molds, Kelly Ball, Flexure and Cube attachments, Capping Sets, Curing Cans and Slump Test Equipment.

52 CONCRETE TESTING EQUIPMENT

Forney's Inc., Tester Div.—Manufacturer offers complete descriptive circulars on compression and flexure testers for Cylinders, Pipe, Tile, Beams, Slabs and Lintels.

RETURN THE COUPON TODAY FOR IMMEDIATE RESULTS!

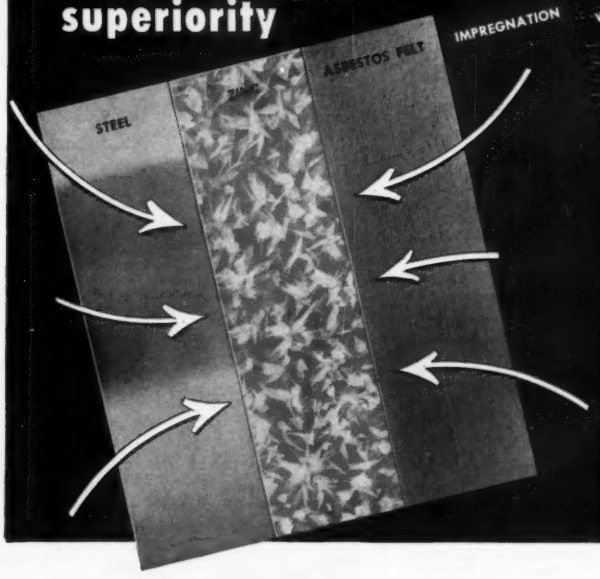
53 CONDUIT SYSTEMS

The Stillwater Clay Products Co.—New, four-page, illustrated brochure describes the revolutionary new and exclusive Cert-A-Bar Tunnel Conduit System, and its many features. Authoritative information on conduit design, installation, engineering, insulation, waterproofing specifications and fittings is also included.

54 CONSTRUCTION GUIDE

The Douglas Fir Plywood Assoc.—announces a new, 34-page four-sectioned construction guide containing full-page structural drawings that provide authoritative basic information on types, grades, and applications of fir plywood for builders, architects, engineers and building code officials. The booklet covers information on floor construction, single and double wall construction, and roof construction, while including recommendations and plywood excerpts from "minimum property requirements" of the FHA.

How molten metal helps give Galbestos its superiority



Robertson Color Galbestos has the greatest resistance to weather and corrosion of any protected steel roofing or siding obtainable anywhere. This position of broad superiority is made possible by a unique manufacturing process exclusive with H. H. Robertson Company.

First, the steel sheet is pickled . . . then given a coating of molten zinc. Asbestos felt is then pressed on so that as the molten metal hardens in cooling it grips the felt fibers in absolute bond. The asbestos is then impregnated with a special asphaltic compound and, finally, given a tough weatherproof coating. Galbestos can be furnished flat or in the 3 well-known corrugations: Standard, Mansard, and V-Beam. The resultant material is so durable, it may be sheared, bent, rolled, crimped and riveted in the field as easily as ordinary unprotected steel. It will withstand the greatest possible extremes in weather temperatures without deterioration, and will actually retard fire better than naked steel. For an industrial roofing or siding that requires no maintenance under the most severe corrosive conditions, specify Color Galbestos.

Long Service Life. Color Galbestos will give longer maintenance-free service under the most severe weather and man-made corrosive conditions. Even salt air cannot penetrate its tough coatings to destroy the steel core.

Not Fragile. Color Galbestos' strong steel core sheet guarantees against breakage—during shipment or during erection.

Resists Climatic Extremes. Color Galbestos is not subject to damage either by tropic or frigid temperatures. Its coatings will not run under broiling sun or crack or spall in sub-zero weather.

Goes Up Fast. The exclusive Robertson Top-Speed method of attaching Color Galbestos to structural steel speeds up erection for quicker occupancy.

Resists Flame. Leading testing laboratories have made exhaustive tests on the fire resistance of Galbestos and have published the results. Copies of these reports are available for study.

NOW AVAILABLE IN SIX USEFUL COLORS FOR ROOFS AND SIDEWALLS

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In England: Robertson Thain Ltd., Ellesmere Port, Cheshire

55 CONSTRUCTION MATERIALS

Texas Vitrified Pipe Company—A comprehensive, 32-page catalog lists complete Tex-Vit line of vitrified clay pipe, clay pipe fittings, glass-lined clay pipe, bituminous and plastic "Jiffy-Joints" for clay pipe, Wedge-Lock plastic joints, channel pipe, perforated pipe, translot filter blocks, flue lining, chimney pipe and fittings, flue rings, fire brick, fire clay, clay pipe heating and ventilating ducts, wall coping and related clay products. Useful reference material also is included.

56 CONSTRUCTION SIGNS

National Safety Engineers—A colorful brochure illustrating numerous road construction signs is offered. Sizes and legends are tabulated. Complete information on special sign requirements is available.

57 CONSTRUCTION SPECIFICATIONS

The Asphalt Institute—Construction Series 80, a 304-page manual contains a variety of asphalt construction specifications for: Priming, Surface Treatment, Road-Mix, Penetration Macadam, Base Courses, Cold-Laid Plant Mix, Hot-Laid Plant-Mix Surfaces and Block Pavement. Price $1.50.

N. B. There is a charge for this book. Make checks payable to The Asphalt Institute.

58 CONTRACT PUMPING

American Dewatering Corp.—A new and well illustrated catalog describing the predraining of many construction projects of typical and unusual interest. Outlines the services and benefits of contract pumping in which this company specializes.

59 CONTROLLING HOT WEATHER CONCRETE

Sika Chemical Corp.—Complete information on controlling the quality and setting time of concrete in the hottest weather is available. Brochures, tests and specifications for Plastiment Retarding Densifier are included.

In filling out the coupon, please print clearly and be sure that you furnish a complete address.

60 CONTROLS FOR LIQUIDS AND GASES

Simplex Valve & Meter Co.—Bulletin 005 lists all major equipment for the measurement and control of liquids and gases. Illustrated are many types of controllers, gauges, manometers, recorders, meters, valves, Venturi tubes, etc., all applicable for water and sewage works, power and processing industries.

61 CORE DRILL MACHINE

Sprague & Henwood Inc.—A new Bulletin 30 completely describes and illustrates Model #30 Core Drill machine. Designed and manufactured by Sprague & Henwood it is being used by their Contract Drilling Departments.

62 CORE DRILLS

Acker Drill Co., Inc.—Acker Bulletin 30 describes the Toredo core drill. The basic Toredo rig can be equipped with either a hydraulic or mechanical screw feed. Power plant can be either gasoline, diesel, air or electric motor. The unit is readily adaptable for mounting on drag skid, jeep, truck or trailer.

63 COST DATA

Barco Manufacturing Company—Of interest to earthmoving contractors is a bulletin of cost data for soil compaction in restricted areas. Specifications accompany the data.

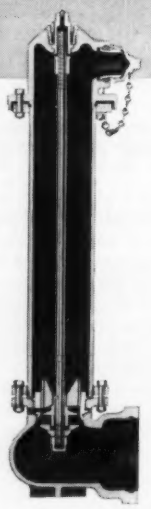
64 CRAWLER TRACTOR

Allis-Chalmers Manufacturing Company—The technical and operating story of the 45 drawbar hp HD-6 diesel-powered crawler tractor is told in a new catalog MS-1101. In addition to specifications, the catalog lists the full line of matched equipment and accessories that have been engineered to the HD-6 which increases its versatility and economy, and provides maximum safety and comfort for the operator.

65 CRAWLER TRACTOR

The David Brown Corp.—A detailed description of the 50 ITD, the crawler that gets things done is given in a colorful bulletin. On-the-job photos plus cut-a-way pictures of the engine and transmission are shown.

R. D. Wood, Leader Since



A Low-Cost Hydrant You Can Depend On

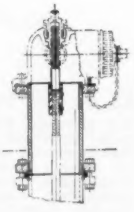
The R. D. Wood Standard Swivel Joint Hydrant gives you the most for your money in strength, reliability and sound design. The *all-bronze stuffing box*, gland and operating nut prevent rust and corrosion. Internal friction which might lower pressure is reduced to well below A.W.W.A. specifications by tapered nozzleways and carefully rounded changes in diameter.

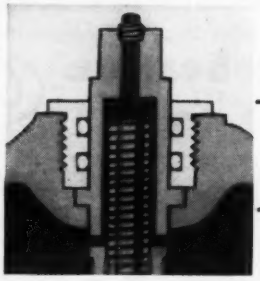
Breakable Flange and Stem Coupling

Available at slight extra cost. Designed to snap under a blow which would otherwise smash the hydrant, flange and stem coupling can be inexpensively and quickly replaced without excavation.

Extension Piece

Can be inserted without interrupting water flow.





Hydrants now available with O-Ring Seal when specified

66 CURING BLANKETS

American Sisalkraft Corp.—A ten-page catalog "Curing and Protecting Concrete Highways" discusses the importance of concrete curing and the many time and labor-saving advantages of white Sisalkraft Curing Blankets. Actual on-the-job photos illustrate the application of this waterproof paper method of curing.

67 CURTAIN-WALL DATA

The William Bayley Co.—Aluminum wall, curtain-wall and steel window wall systems are the subject of a new data reference file. Included are three brochures with specifications and detailed information as well as several folders of diagrams illustrating various window and curtain-wall systems.

68 DENSLUDGE DIGESTION SYSTEM

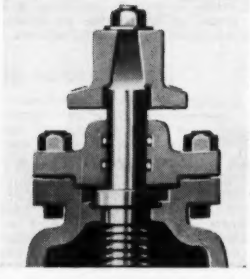
Dorr-Oliver Inc.—A new 16-page, two-color bulletin is now available. It describes the development, equipment, operation, typical applications and design loadings of this new sewage sludge digestion system and the means by which digester capacity requirements are substantially reduced. Operating results from three full-scale treatment plants are cited. Also included are wash and line drawings and photographs of the various equipment units and a flowsheet of a typical system.

PLEASE PRINT
NAME CLEARLY.

1803, Presents

A Gate Valve Built for Generations of Trouble-Free Operation

The R. D. Wood Gate Valve can be depended on to work and keep on working for years. It is simply constructed—a spreader and two discs are the only moving parts. The discs are free to revolve their full circumference, preventing uneven wear on faces and seats. When fully open, gates are entirely clear of flow.



R. D. Wood Gate Valves now available with O-Ring Seal when specified

all available with mechanical joint and flange-type pipe connections

R. D. WOOD CO.

Public Ledger Building, Independence Square • Philadelphia 5, Pa.

Manufacturers of Mathews Hydrants and "Sand-Spun" Pipe (centrifugally cast in sand molds)

69 DEPTH SOUNDER

Edo Corporation—A four-page brochure describes the Model 185 AN/UQN-1B, precision deep depth sounder, with a range from 0 to 6,000 fathoms, which was developed for the U. S. Navy and is now available commercially.

70 DESIGN HANDBOOK

Concrete Reinforcing Steel Institute—Here is the book, revised and with much new added material that practically does your designing for you or any type of reinforced concrete member. This unique tool eliminates confusing formulas, time consuming calculations—you read off the answer to your reinforced concrete design problem. Price $6.00.

N. B. There is a charge for this book. Make checks payable to concrete Reinforcing Steel Institute.

71 DIAMOND BIT

Sprague & Henwood, Inc.—Any bit you buy will work for a while. But if you specify or order "Oriented" Diamond Bits, giving all information on your drilling conditions, you will receive the bit or bits that will do the best job for you. Lower your cost per foot, with a minimum of diamond loss. Write today for complete "Oriented" Diamond Bit Bulletin No. 320-1.

72 DIRECTORY ON FIRMS

International Harvester Co.—A 40-page book just made available is chockful of informative data on manufacturers who use IH engines as original equipment in their products. This directory or original equipment manufacturers gives you a handy reference of machine types and models, together with the IH engines used. An index permits the quick location of any manufacture desired. The machines are grouped in alphabetical order according to general types, which also facilitates reference.

73 DOCKS, WHARVES AND MOBILE DRILL BARGES

DeLong Corporation—A new 20-page, profusely illustrated booklet describes the DeLong method of installation of prefabricated docks, wharves and other structures including mobile offshore drill platforms by means of the DeLong Jack. Also describes the famous Texas Tower project, a mobile aerial cableway system and other commercial and military installations.

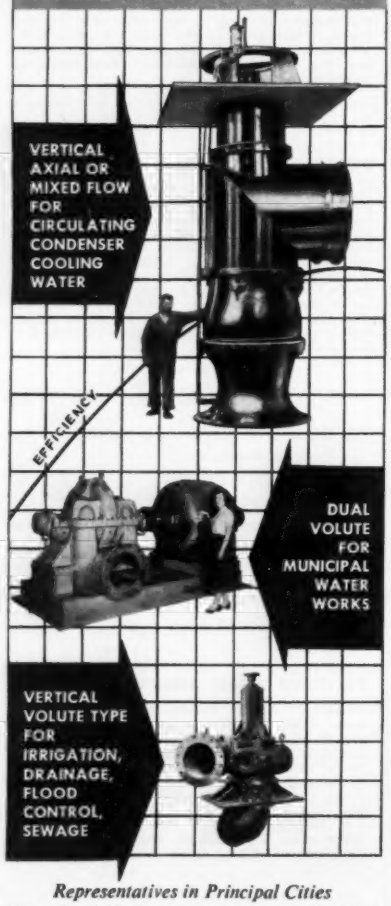
74 DOWEL BASKET ASSEMBLY

Universal Form Clamp—New heavy duty type dowel basket assembly as been approved by many State Highway Departments including Illinois, Michigan, Wisconsin and Ohio. New assembly has been used on toll roads and on the Ohio and Indiana Turnpikes. Completely assembled and welded units are furnished along with all other transverse and longitudinal joint requirements such as stake pins, base plates, construction or expansion materials, hook belt assemblies or tie bars.

DID YOU MAKE YOUR CHECKS PAYABLE TO THE PROPER COMPANIES? ARE THE AMOUNTS CORRECT?

PUMPS
on which an ENGINEER Can Base His Reputation . . .

Wheeler-Economy Pumps are the development of over 40 years of engineering concentrated on pumps for circulating water, condensate, water supply and drainage. Quality of materials and workmanship, design efficiency and long life are a credit to the engineers who write "Wheeler-Economy" into their pump specifications. Service records of 20 years or more without replacement of major parts, give you assurance that Wheeler-Economy Pumps are built to last. Here are only a few from our extensive line of pumps available for your specific engineering problems.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DUAL VOLUTE FOR MUNICIPAL WATER WORKS
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ECONOMY PUMP DIVISION
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CATALOG DIGESTS

75 DRAIN GRATES

Irving Subway Grating Co., Inc.—A recently published four-page, two-color folder illustrating the use of open mesh steel flooring as drain grates is now available. The folder contains photographic illustrations and shows typical uses of drain grates. There are engineering drawings of the various types and complete technical data to facilitate estimates and specifications.

76 EARTHMOVING EQUIPMENT

M-R-S Mfg. Co.—A booklet in color illustrating the complete line of contractor-proven high capacity earthmoving equipment is now available. Tractors and scrapers designed to work as a team for maximum production are described fully. Complete specifications are also given.

77 ECONOMY PUMPS

C. H. Wheeler Mfg. Co.—Economy type M pumps for medium and high head service are described and illustrated in a new eight-page bulletin A-155. Their advantages of high efficiency and low maintenance are described and cross section designs are shown for bottom suction and side suction types. Construction details are included.

78 ELEVATED TANKS

Pittsburgh-Des Moines Steel Co.—Details of the several different types of elevated steel tanks, including capacity, ranges, tank dimensions, and other factors to be considered in the selection of storage tanks. Also available, 4 pages of pictures and discussion about flat bottom water storage.

79 ELIMINATE DESTRUCTIVE MOISTURE

W. R. Meadows, Inc.—The practical solution to the problem of eliminating destructive moisture in all types of construction is fully explained in the brochure, Sealtight Products For Better Construction. This brochure contains complete product information, installation information, installation drawings and architectural specifications.

80 ENGINEERING FOR PRODUCTION

Grumman Aircraft Engineering Corp.—An engineering recruiting booklet for one of the chief suppliers of Naval aircraft, this publication gives a well-rounded picture of engineering opportunities at this corporation. It is addressed to engineers whose creative thinking ranges far beyond today's aircraft in anticipation of the tremendous developments in powered flight, developments which imaginative Grumman engineers will produce.

81 EQUIPMENT FOR TREATMENT PLANTS

Jeffrey Mfg. Co.—Catalog 905 offers complete information on equipment for water, sewage and industrial waste treatment. Screens, grinders, grit collectors, collectors, Floctrols (controlled Flocculation) etc. are illustrated with on-the-job photos.

82 EVAPORATION EQUIPMENT

Goslin Birmingham Mfg. Co.—Designed, fabricated and guaranteed by G. B., evaporator installations of all materials of construction —cast iron, steel, stainless nickel and copper,—are serving the sugar, paper and chemical process industries throughout the world. Bulletin 510 illustrates in detail phases of the designing, manufacturing, and assembling of this equipment.

83 EXPANSION PLATES & BUSHINGS

Lubrite Div., Merriman Bros., Inc.—Manual No. 55 contains complete information, technical data, and specifications about Self-Lubricating Expansion Plates and Bushings for bridges, buildings, refinery equipment and chemical processing equipment applications.

84 EXPOSED CONCRETE AGGREGATE

Sika Chemical Corp.—This four-page brochure describes two ways of obtaining exposed concrete aggregate during construction. This exposed aggregate can serve as a bonding surface at construction joints or have a decorative architectural effect on precast panels. On horizontal surfaces, Rugasol-C, Retardant Concrete Coating is applied directly on the freshly placed concrete. On vertical surfaces, or precast panels, Rugasol-F, Retardant Form Coating, is applied on the forms before or after erection.

85 EXTRUDED GRATING

Washington Aluminum Co., Inc.—An eight-page booklet in color describes the many uses of gratings and treads of aluminum. Extruded grating is a most versatile product since its various depths, and punchings make them suited for marine, industrial and commercial applications. Specifications and a safe tread table are included.

86 FACILITIES AND PRODUCTS

Newport News Shipbuilding and Dry Dock Co.—A well illustrated and informative catalog with pictures is offered showing a presentation of the facilities acquired during 68 years of continuous operation, together with some of the items of industrial equipment that have been produced with these facilities.

87 FIBRE FORMS

Sonoco Products Co.—Uses of Sonotube, fibre forms, are illustrated in a new brochure. These fibre forms provide an economical method of forming round, obround, half-round and quarter-round columns. Also encasement of steel and wooden piles, existing columns and utility risers. Available in several different types, the newest which provides a form surface requiring little or no rubbing of the finished column. Technical data also available.

There are 257 Digest items on pages numbered 130 to 158. Read all items for the literature of interest to you.

CATALOG DIGESTS

88 FIBRE TUBES

Sonoco Products Co.—Sonovoid, fibre tubes, were specifically developed to form voids in bridge decks; wall, floor, roof and lift slabs and in concrete piles. Uses illustrated in a new brochure. Sonovoid, fibre tubes, are used in precast or cast-in-place units of conventional or pretensioned construction. Tie down and spacer method shown along with design data for 8-in. and 12-in. slabs. Other technical data available.

89 FLOATING-FINISHING MACHINES

Whiteman Mfg. Co.—Leaflets announcing the new models of their machines are available. Designed specifically for small areas, the Model J-1 offers several new improvements. Model B-1 now provides greater utility, ease of operation, etc. The Model M troweling machine is a new small unit which does a big job.

90 FLOOR ARMOR

Irving Subway Grating Co., Inc.—Just published is a new catalog on Gridsteel floor armor. Gridsteel is made of steel bars on edge, bent and joined together in a continuous hexagonal mesh pattern. Floors armored with Gridsteel last indefinitely. Gridsteel prevents ruts or potholes from forming, gives an even tractional floor surface at all times. Catalog illustrates uses, advantages, and shows how quickly and simply Gridsteel is installed.

In filling out the coupon, please print clearly and be sure that you furnish a complete address.

91 FLOOR GRATING AND STAIR TREADS

Kerrigan Iron Works, Inc.—A 16-page catalog gives a picture story of Weldforged grating and stair treads with continuous spiral cross bars alternating right and left, and slightly above bearing bars for extra safety. Electronically Weldforged into solid, one-piece units for strength and durability. Contains safe load table, engineering data on both grating and treads.

92 FLOOR GRATINGS

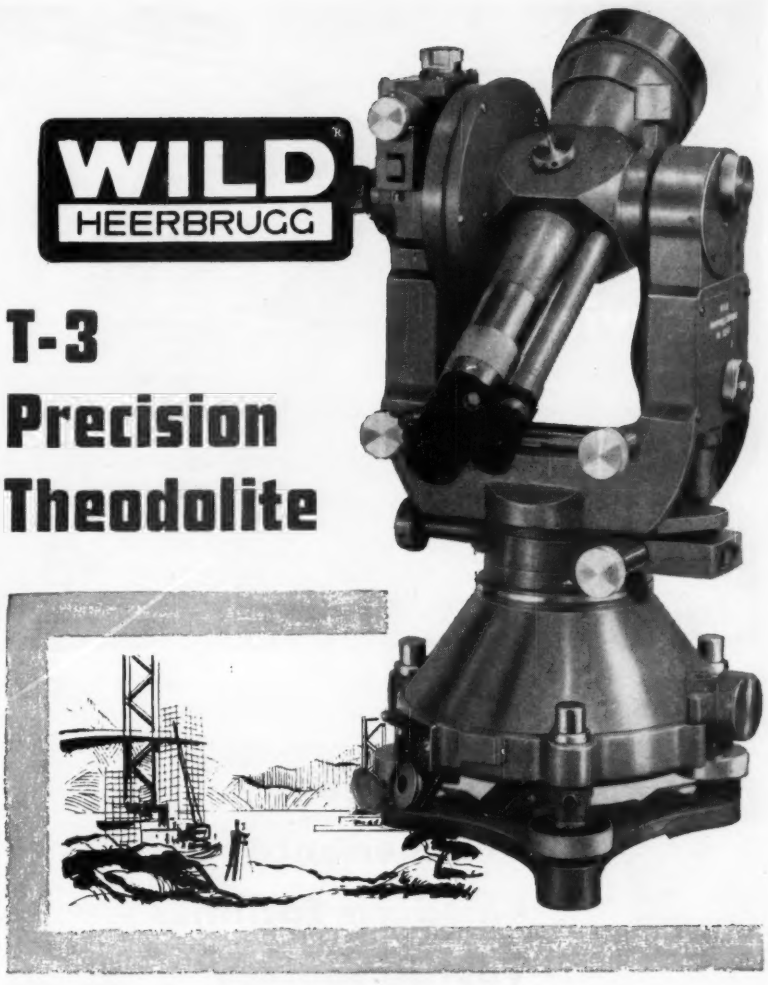
Borden Metal Products Co.—A catalog containing technical information on how to select, design, purchase and install floor gratings, safety steps, and floor armour, available in steel, aluminum or stainless alloys, is offered. Safeload tables, step-by-step procedure of ordering, planning and checking is included.

93 FORMING EQUIPMENT

Symons Clamp & Mfg. Co.—A new 8-page catalog has been released describing in detail, advantages of Symons' lightweight plywood forms, magnesium forms, and wood rim forms as well as form hardware, shore, ties, and column clamps. Completely illustrated, the catalog shows on-the-site applications of equipment along with cutaway drawings and photographs of corners, pilasters, fillers, walers, curves, and bracing and scaffolding. Also shown are such supplementary equipment as bar ties, tie chairs, washer ties and erection hardware.

WILD
HEERBRUGG

T-3
Precision
Theodolite



A WILD *instrument designed for highest accuracy, time-saving conveniences, and a remarkable work potential*

The Wild T-3 Precision Theodolite is the supreme instrument in its class . . . for accuracy . . . versatility . . . and for its proved reliability in virtually all conditions of weather and climate.

The T-3 is an ultimate instrument for Geodesy and for precision triangulations. It has a distinguished record in triangulating the longest bridge spans in the world.

NOTABLE FEATURES OF THE WILD T-3

- Performs triangulations of the first and second order.
- Circle reading direct to 0.2 seconds.
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- No eccentricity error.
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CATALOG DIGESTS

94 FOUNDATION PIPE

L. B. Foster Co.—Important features of Taylor foundation pipe are discussed in Bulletin 542. On-the-job photos illustrate installations and piling used. Charts of sizes and typical pile driving logs are included.

95 GAGING SYSTEMS

Shand and Jurs Co.—Bulletin T-455, "Telepulse Remote Reading Gaging Systems" discusses a system which incorporates some of the best equipment of both the telegraph and the dial telephone, modified to the particular requirements of the system. The S & J Telepulse reports liquid levels quickly and accurately over any distance within the range of modern communications system.

96 GATE VALVES

Lunkenheimer Co.—Completely illustrated Circular No. 561, graphically describing a complete line of all-iron and iron body, bronze mounted "King-Clip" Gate Valves, includes complete specification data and leading dimensions. The Gate Valves are designed for disassembly and reassembly without removal from the line. Other features include large drain channels that reduce bonnet chamber clogging in handling congealing fluids.

DID YOU MAKE YOUR CHECKS PAYABLE TO THE PROPER COMPANIES? ARE THE AMOUNTS CORRECT?

97 GEARS

The Earle Gear and Machinery Company—A twenty-page catalog describes in general, the kinds and sizes of gears manufactured by this company. Its contents deal with spur gears, bevel gears, helical gears, worm gears, racks, non-metallic gears, sheaves, sprockets, special machinery of which gears form a part, and special gear information. Illustrated with photographs, it also shows actual Earle installations.

98 GOOD PRACTICE IN SEWER CONSTRUCTION

Clay Sewer Pipe Association—A four-page, fully illustrated Bulletin entitled "Good Practice in Sewer Construction" has been published. Complete data on proper techniques for finishing, backfilling, inspection and trench preparation, including trench width, depth and type of bedding is included.

99 GRATING FLOORING AND TREADS

Irving Subway Grating Co., Inc.—General Grating Catalog F400 contains illustrations, descriptions and complete engineering data on grating flooring, treads and floor armoring (riveted, press-locked, welded types). Irving Grating is safe, durable, fireproof, ventilating, clean and economical for industrial and power plants and refinery walkways, stairways, driveways, trucking aisles.

CATALOG DIGESTS

100 GRATINGS

Borden Metal Products Co.—A new 16-page catalog shows the three basic types of grating construction; more than 30 dimensional drawings of subtypes; eight safeload tables covering steel and aluminum gartings, roadway grating and sidewalk slabs plus other tables on panel widths, tread widths, floor armor, etc. Also shown are the various safety treads and their nosings. Included are the steps for careful planning and checking of the job.

101 GUNITE

Pressure Concrete Company—Has a 48-page illustrated, free booklet on Gunite in all of its phases. The booklet contains specifications, job stories and illustrations showing Gunite repair of reservoirs, dams, filter plants, sewage disposal plants, stadiums, bridges, stacks and bunkers. The booklet also contains photographs on new prestressed tank construction and other data. A new leaflet just published illustrates pressure grouting to dams.

102 HEAD PULLEYS

Yuba Mfg. Co.—A new, 4-page folder, describing and picturing Yuba-Schrock internal drive head pulleys, has just been released. It explains the advantages of "the head pulley in use by contractors, a steamship line, batch plant manufacturer, and aggregate producers; contains an easy to read chart of sizes, dimensions and operating speeds.

103 HEAVY-DUTY TRAILERS

Birmingham Mfg. Co.—have just published their catalog "E". This covers their standard line of low-bed trailers through 75-tons, complete with dimension sketches and photographs of all their models and accessories. It also has a section on jeep dollies, telescopic trailers, trailer trains and many other special applications in the heavy duty field. This company has produced trailer train up to 265 tons capacity and these are also illustrated.

104 HIGHWAY BUILDING PROGRAM

Caterpillar Tractor Co.—A vital part of the new highway building depends on public knowledge to get the roads built where they are needed. To answer the questions that are being and will be asked about the new road program, a new booklet has been released called "The Road Ahead," designed to give the public a working knowledge of the future of American highways under this program.

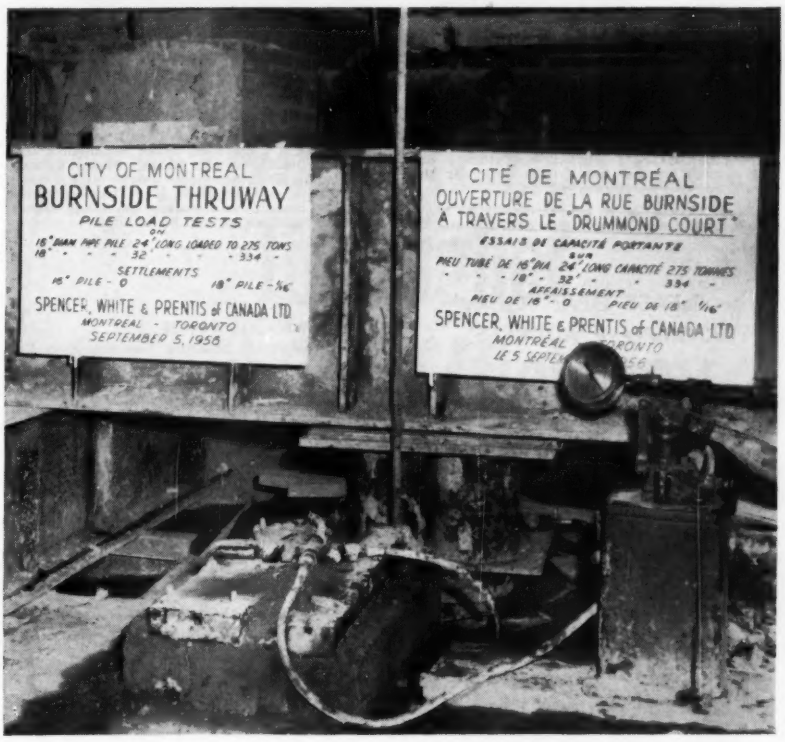
In filling out the coupon, please print clearly and be sure that you furnish a complete address.

105 HI-HED REINFORCED CONCRETE PIPE

American-Marietta Co.—An illustrated 12-page folder showing how H-Hed Pipe is used where unlimited fill requires greater strength and capacity than equivalent size of round pipe. Also how this versatile pipe saves trench width in congested areas. Available at all A-M Concrete Products Division plants, Hi-Hed offers higher dry weather flow velocity and is available in a full range of equivalent round pipe diameters from 18-in. through 144-in.

ANOTHER PROBLEM SOLVED BY SPENCER, WHITE & PRENTIS

NOTEWORTHY LOAD TEST IN COMPLEX PILE-DRIVING JOB



Project: Alteration of Drummond Court for new roadbed.
General Contractor: J. P. Cartier, Ltd., Montreal, Canada.
Engineers: Surveyor, Nenninger & Chenevert, Montreal, Canada.

Our Canadian affiliate performed this work, the purpose of which was to alter a building to permit a street to pass through. More than a hundred piles were driven, 33 of them indoors with limited headroom.

Under these difficult conditions, the load test results (see photo above) were as follows:

Net settlement, 16-inch pile—0"
Net settlement, 18-in. pile—1/16"

Though these particular results are exceptional, they do come out of a general background of *consistently* high standards in complex pile-driving work.

On request, we will be glad to tell you about the experience, the methods and the specially-built equipment which we have available for dependable handling of your pile-driving problems.

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OF CANADA: 700 BAY ST., TORONTO · 2052 ST. CATHERINE ST. WEST, MONTREAL

106 HORIZONTAL SHORING

Spanall of the Americas, Inc.—Newly published is an 8-page catalog on the subject of Spanall, registered trade name of a prestressed all-metal horizontal shoring, now available for all types of beam and slab concrete floor forms. The catalog contains descriptions of the products, including all essential engineering and application data. Detailed isometric drawings and two pages of photographs illustrate typical installation techniques.

107 HOW TO CORE DRILL

Acker Drill Co., Inc.—"Basic Procedures of Diamond and Shot Core Drilling" shows with over 80 illustrations and drawings the fundamentals of core drilling practice. Pipe driving, core recovery, core logging and storage are all covered in this pocket size book for the beginning driller. The price is $1.00.

N. B. There is a charge for this book. Make checks payable to Acker Drill Co., Inc.

PLEASE GIVE YOUR COMPLETE ADDRESS.

108 HYDRAULIC BACKHOE

Hyster Company—A brochure illustrating the new Hydraulic D4 Backhoe. The eight important features assuring outstanding performance on all jobs are discussed in detail.

109 HYDRAULIC DATA BOOK

Leupold & Stevens Instruments, Inc.—Interpretative data on water measurement and control is at your fingertips in this 144-page revised edition, in three parts: float wells and instrument shelters; errors in float operated devices; hydraulic tables; plus pages for notes and memorandums. Indispensable for the engineer with its wealth of information, tables and illustrations, the price of the book is $1.00.

N. B. There is a charge for this book. Make checks payable to Leupold & Stevens Instruments, Inc.

110 HYDRAULIC TURBINES

The James Leffel & Co.—Details on the turbines which drive both power generation and pumping units at the United States Bureau of Reclamation, Chandler Power and Pumping Plant, are given in a 12-page Bulletin 1098-E. Descriptive literature on other recent turbine installations will be inclosed.

111 HYDRAULIC VALVES

The Commercial Shearing and Stamping Co. 92 pages of up-to-the-minute, factual information of Commercial Oil Hydraulic Valves for controlling fluid power when used to control the operation of cylinders and motors. Performance data, capacities, types, sizes details and mounting dimensions of these new "Performance Rated Valves" give all necessary information to enable proper design and application into hydraulic systems.

112 INDUSTRIAL PRODUCTS CATALOG

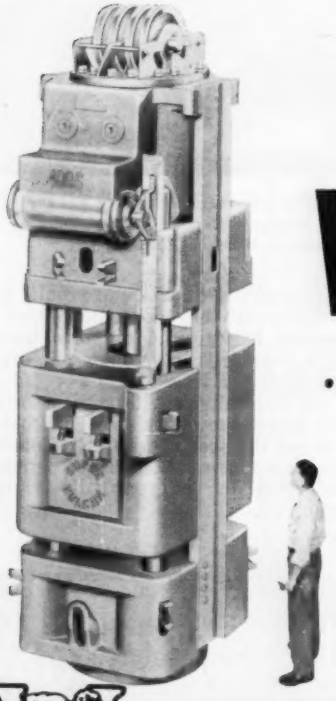
Johns-Manville—Has issued a 52-page catalog which offers essential data on the following groups of products: Insulations, refractory products, asbestos cement pipe, packings, gaskets, electrical products, frictional materials, roofing, siding, flooring, partitions, and ceilings. Photographs, diagrams, and tests have been revised and brought up-to-date so that engineers and plant executives will have the latest information in a compact catalog that is easy to use.

113 JOBS DESCRIBED

Boeing Airplane Company—An extensive brochure is offered describing the roles of aeronautical, civil, electrical and mechanical engineers, mathematicians and physicists in the design, research and production of advanced commercial and military aircraft and guided missiles at this company. Home address requested.

114 JOINT SEALER AND WATERSTOP

Sika Chemical Corp.—A brochure describes the four new consistencies of Igas Joint Sealer. The stiffer consistencies are used for water reservoirs, swimming pools, tunnels and deep basements. Lighter consistencies are used where there is no actual water pressure such as joints in metal building panels. Specifications and architectural details are included.



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115 JOINTS FOR VITRIFIED CLAY PIPE

Clay Sewer Pipe Association—Five tested methods for jointing vitrified clay pipe are described in a new, two-color, four-page Bulletin. Detailed instructions are given for jointing hot poured bituminous joints, Wedge-Lock joints, pre-cast bituminous joints, mortar joints, and Pressure joints, plus valuable information on preparing trench beds and backfilling.

116 K-45 KOMPACTOR

Buffalo-Springfield Roller Company—An illustrated 8-page colored booklet giving complete specifications and on-the-job performance reports of the K-45 Kompactor. The time saving, cost cutting Kompactor is self-propelled, highly maneuverable. Works on steep banks and all but eliminates hand-tamping. Features exclusive compaction principle.

RETURN THE COUPON TODAY FOR IMMEDIATE RESULTS!

117 LAYING CONCRETE PRESSURE PIPE

Price Brothers Company—A pocket-size book of instructions for laying concrete pressure pipe via the backhoe method contains up-to-date instructions (with photos and drawings) of proper trenching, checking grade, handling pipe, and completing the flexible watertight rubber and steel joint. Also shows a check list of equipment and supplies needed for the job.

CATALOG DIGESTS

118 LIMI-TORQUE CONTROL

Philadelphia Gear Works—28-page catalog L-550, gives background information on this automatic, power activated device for controlling all types of valves and sluice gates. It describes the available types and lists specific applications. Installations are shown in power plants, refineries, and in various industries.

119 LONGSPAN JOISTS

Haven-Busch Co.—A 32-page catalog describing the new longspan series joists SJI-AISC and includes Top Chord Extension graphs, maximum moment table, load-carrying tables, panel dimensions, and other pertinent design data.

120 LOW TEMPERATURE SPACE INSTALLATIONS

Pittsburgh Corning Corp.—A new 20-page booklet, contains complete information on the latest recommended methods for installing Foamglas cellular glass insulation on walls, floors, ceilings and roofs of refrigerated spaces operating between 50-deg F and plus 50-deg F. It lists suggested thicknesses as well as recommended adhesives, finishes, paints and other accessories for use with Foamglas in low temperature installations. The material is presented in an easy to read fashion with many illustrations and photographs.

121 MAPPING PRODUCTS

Fairchild Aerial Surveys, Inc.—A quick reference guide to Fairchild mapping products shows the materials and methods for producing different types of maps. Included are oblique and vertical photos, photo index and line index, controlled mosaic or photomap, topographic contour map, magnetic contour map, and radioactivity contour maps and strip chart.

DID YOU MAKE YOUR CHECKS PAYABLE TO THE PROPER COMPANIES? ARE THE AMOUNTS CORRECT?

122 MARINE EQUIPMENT

Bludworth Marine—New literature available describing: Depth Recorders for underwater survey, dredging, oil exploration; Underwater T.V. Camera, continuous picture on monitor screen on boat or land, depths to 180 ft; Metal Locator, pinpoints ferrous and non-magnetic metals in fresh and salt water; "Power Diver", self propelled for depths to 200-ft. Also on Radiotelephones and new low cost small boat Radar.

123 MASONRY PROTECTION

Standard Dry Wall Products, Inc.—Circulars No. 38 and 47 are offered giving complete information about the Thoro System which corrects or prevents many water problems in masonry. Profusely illustrated with on-the-job photos this system is carefully explained as to the method of prevention of water problems rather than correction.

Two New Guides for Higher In-and-Out Efficiency

Be sure you have these new, complete door guides — your keys to lowest costs and highest efficiency wherever traffic or equipment moves in and out of buildings. You get full data on Kinnear Steel Rolling Doors with the famous *Kinnear-originated* interlocking slat curtain. Also details on sectional-type Kinnear Rol-Top Doors (wood or all-steel) . . . Akbar Rolling Fire Doors, for positive automatic protection in case of fire . . . Kinnear Rolling Grilles (block passage but not light, air, vision, or sound). *Write today for your free copies of these new Kinnear Door books. No obligation!*

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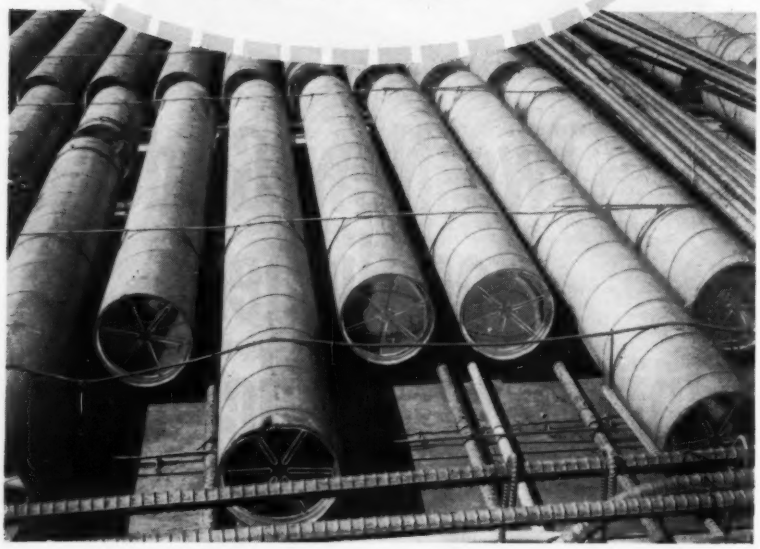
save material and reduce weight of concrete slabs!



Construction of floor slab. Boulder Life Ins. Co. Bldg., Boulder, Colo. Jack Cys, Denver Col., contractor.

SONOCO SONOVOID®

FIBRE TUBES

for voids in concrete construction

Save concrete and reinforcing steel . . . use low-cost SONOVOID Fibre Tubes to displace low-working concrete at the neutral axis without impairing structural strength. In the construction of floor slabs for The Boulder Life Insurance Co. Building, SONOVOIDS were used to eliminate the dead weight of concrete and to save materials and money.

Metal end closures were used in the SONOVOIDS. Special tie-down rods, with spacers attached, prevented the SONOVOIDS from "floating" and assured exact positioning prior and during the pour.

Easy-to-handle, low-cost SONOVOIDS are specifically developed for use in bridge decks, wall, floor, roof and lift slabs; also in concrete piles. For poststressed or prestressed units or units cast in place.

Available in Sizes from 2.25" to 36.9" O.D. up to 48' long.

Order in specific lengths or saw to your requirements on the job. End closures available.

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CATALOG DIGESTS

124 MEASURING FLUMES

Thompson Pipe and Steel Co.—Four pages of tables on Free-Flow Discharge of the Parshall Measuring flumes are included in an attractive Catalog B-31-C, describing these devices for accurate measurement of irrigation in ditches or open channels.

125 METRIC WALL CHART

Mayo Tunnel and Mine Equipment—Simplified metric conversions, originally designed for the Mayo company office is now available. Newly revised chart includes: feet to meters; inches to meters; decimals of a foot; meters to feet plus other useful conversion factors. Illustrated are steel forms, tunnel shields, grouters and other equipment for the mining industry.

126 MOLOX BALL JOINT PIPE

American Cast Iron Pipe Company—New illustrated catalog contains instructions for assembly, weight and dimension tables and different methods of installing Molox Ball Joint Pipe for river crossings and submarine service.

127 MOTOR GRADER

Galion Iron Works & Mfg. Co.—The Model T-600 Grade-O-Matic Motor grader is illustrated in a colorful 17-page catalog No. 415. Advantages and features of the Galion designed and built hydraulic system are explained clearly together with photos of the various parts which seem to make this motor scraper outstanding. Attachments and special equipment are also included.

128 MOTOR GRADERS

Galion Iron Works & Mfg. Co.—Bulletin 148, 419 and 420 offer descriptions of the Galion line of motor graders, Models 118, 104 and 450. Detailed diagrams of their structures are given.

129 MOTOR SCRAPER

Allis-Chalmers Manufacturing Company—Engineering, design, construction and mechanical features of the new TS-360 motor scraper that make it a big capacity earthmoving unit are outlined in a new 16-page two-color catalog MS-1104. Photographs and drawings assist the reader to understand better the many advances incorporated in this 20-cu yd heaped or 15-cu yd struck capacity scraper powered by a 280-hp diesel engine.

130 MOTOR SCRAPER

Allis-Chalmers Mfg. Co.—The design, engineering, construction and operating features of the new TS-260 motor scraper is explained in a 16-page, two-color catalog MS-1105. Photographs show engine, power, train, steering, brake and other components that combine into dependable operation and performance and add up to operator comfort and safety.

131 MOVALLS

C & D Division, Yuba Mfg. Co.—A 4-page folder titled "Movalls or End-Dump Trucks?" has just been released. It compares end-dump trucks and positive-ejection Movalls on eleven different points and is liberally illustrated by on-the-job action photos.

132 NEEDLE VALVES

Lunkenheimer Co.—Completely illustrated folder describes Gland-Type Needle Valves. These precision needle valves are applicable to instrument lines, orifice meters, gauges, by-passes, fine regulation of gases and liquids, and other functions where "eye-dropper" accuracy of flow control is required. Folder lists dimensions and seat opening tables and is profusely illustrated with photographs and cross-sectional drawings.

133 NEW ASPHALT LINER MANUAL

W. R. Meadows, Inc.—announces the availability of a new "Hydromat" Asphalt Liner Manual. The "Hydromat" Manual fully describes applications and contains installation information, necessary technical engineering data and specification information. This is not a sales catalog, but strictly a Technical Data Manual.

134 NEW DESIGN MANUAL

W. R. Meadows, Inc.—has prepared a new manual entitled "Design Techniques for Controlling Moisture in Building Structures." This manual, prepared by a firm of technical engineering writers, was originally planned to sell for $1.00 per copy. However, as this problem is of vital interest to all in the construction industry, this company will now send a free copy to all architects, engineers and builders who desire a copy for their file.

135 NEW T-16 OPTICAL TRANSIT

Wild Heerbrugg Instruments, Inc.—Many new design concepts are embodied in the T-16 Optical Transit, now available. The instrument is reportedly designed for ease and speed of operation. Circles are read at a glance to 1-min directly and to 20-sec by interpolation. A built-in repeating clamp is used for setting on zero and eliminates lower plate motions. A new optical plummet giving an upright image has also been incorporated in the T-16.

136 NEW PRODUCTION PENCIL

Venus Pen & Pencil Corp.—This new pencil is made in a series of 6 colors for use in making markings that will reproduce by most any process. The Thermocopy pencil kit is available for testing on your own equipment.

137 NEW WATERSTOP MANUAL

The Durajoint Technical Information Center Contains complete information on Durajoint and Duraseal Polyvinylchloride-PVE Waterstops, for expansion and construction joints. "Durajoint" was specifically compounded and designed for use between adjacent sections of concrete structures. "Durajoint" may be spliced on the job by merely applying heat and holding the ends together until bonded. Requires no welding or vulcanizing equipment.

138 NON-REPRO PENCIL

Venus Pen & Pencil Corp.—An interesting circular is offered describing the Venus Non-Repro Pencil. A rounded hexagon pencil with gold finish metal back cap and distinguished with a purple band, its translucent colored lead for non-reproducible images on translucent papers or masters is recommended when making duplicate copies by Dazio process such as Bruning, Ozalid or similar equipment.

RETURN THE COUPON TODAY FOR IMMEDIATE RESULTS!

139 NON-SHRINK MORTAR

The Master Builders Co.—How to get better results in 12 important construction operations by using non-shrink mortar, is discussed in a new bulletin just published. The operations are illustrated in a building cross section view as cover such applications as waterproofing walls and joints, grouting building columns, machinery and anchor bolts, to caulking sewer pipe joints, etc. Each application illustrated is keyed to a short explanatory paragraph.

HYDRAULICS TRANSLATIONS

To avoid duplication of effort and to bring the hydraulics engineer a definitive list of available translations of literature on hydraulics, the Committee on Research of the Hydraulics Division has prepared "A List of Translations of Foreign Literature on Hydraulics." This material is available as ASCE Manual 35—the latest of a renowned series of authoritative publications on civil-engineering subjects. This Manual can be ordered by clipping this coupon and remitting as indicated below.

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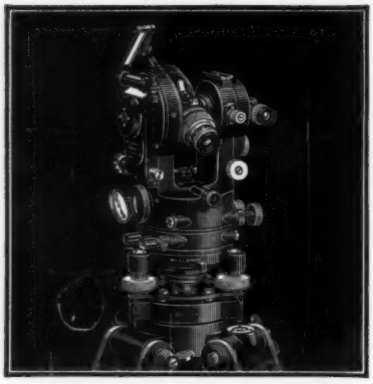

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CATALOG DIGESTS

140 NUTS AND RIB BOLTS
NUTS AND BOLTS

Automatic Nut Co., Inc.—A 4-page folder in color is offered for the attention and use of Architects, Bridge Engineers, Construction Engineers, Contractors, etc., explaining the economical use of rib bolts with Anco-Nuts. Load Chart, standard dimensions, weights and specifications are included.

141 OPPORTUNITIES IN ENGINEERING

Northrop Aircraft, Inc.—An informative brochure describing the many engineering opportunities in such projects as inertial and celestial guidance, boundary layer research and others associated with the Snark intercontinental guided missile and the new T-38 supersonic jet trainer, is now available. The excellent working conditions in Northrop's new multi-million dollar engineering and science center, the benefits of working with Northrop, and the advantages of Southern California living are vividly explained in this free booklet.

142 OPTICAL TRANSIT

Geo-Optic Co., Inc.—An optical transit with erecting eyepiece, double center, T 50, represents a new low priced precision instrument enabling surveyors, engineers, etc., to cope with any possible problem of triangulation and to obtain results of the highest accuracy. A leaflet explaining this new type of theodolite is available.

143 DESIGN OF CONCRETE AIRPORT PAVEMENT

Portland Cement Association—This 48-page booklet on the design of concrete pavement for airports presents design charts for determination of pavement thickness and concrete resurfacing. Also included are recommendations for jointing layout, the use of sub-base under concrete and the evaluation of existing pavements.
(Sent in U. S. and Canada only.)

144 PAVING HANDBOOK

American Bitumuls & Asphalt Co.—The latest edition of the Bitumuls Paving Handbook covers a wealth of practical data on paving methods and materials. These include road and airport paving specifications and construction details, complete tabular data on asphaltic binder applications and aggregate requirements, with condensed Asphalt Institute specifications. Also, there is data on Laykold compounded asphalts for flooring, tennis courts, and protective coatings.

145 PAVING PRODUCTS CATALOG

W. R. Meadows, Inc.—A new catalog on Sealtight Paving Products . . . covering asphalt expansion joints, corkfill expansion joints, fibre expansion joints, center strip, dummy joints, concrete curing compounds, subgrade paper, base plate, rubber asphalt joint seal, sewer joint compounds and road marking paints is offered. The catalog not only contains all of the general information on each product, but also a Standard Specifications section that truly explains what specifications each product meets.

146 PENCIL SAMPLE KIT

Venus Pen & Pencil Corp.—The Venus blueprint pencil sample kit is available. With specially formulated lead, the pencils give clear, non-smear markings on all blue or white prints and coarse papers. The Kit includes two new Venus blueprint pencils and a drawing pencil.

147 PHOTOGRAMMETRY

Jack Ammann Photogrammetric Engineers, Inc.—a new article entitled "Photogrammetry in Engineering and Allied Fields" explains how photogrammetry is used by City Engineers, Highway Engineers, and others. Shows examples of photographs and maps as well as including photographs of equipment used.

148 PILE DRIVING

C. L. Guild Construction Co., Inc.—A new eight-page brochure entitled "Pile Driving" includes a fairly comprehensive brief on piles and pile driving. This literature also describes in great detail the Cobi Cast-in-Place Concrete Pile, gives specifications and the method of installation. The brochure is amply illustrated with action photographs and various completed structures which rest on Cobi piles. Included also are detailed examples of recent load tests made on Cobi Cast-in-Place Concrete Piles.

149 PILE REPAIR

Masonry Resurfacing & Construction Co., Inc.—An eight-page illustrated pamphlet is offered describing the Dri-Por system of pile repair and encasement. The pamphlet describes the application of the Dri-Por system to the repair of the 5-mi James River Bridge system near Newport News, Va. Also included is a description of the Dri-Por K-box which allows repair of concrete piling in the dry, and high quality repair for wood and steel.

150 PILES

The Union Metal Mfg. Co.—Catalog No. 31 on Monotube piles, in addition to general descriptive information, contains engineering data covering physical properties, specification suggestions and test loading; also, contractor data on concrete volumes and weights. It includes numerous photos showing a wide range of job applications throughout the country. Advantages listed: light weight, easy handling, economical field extendability, visual inspection after driving, highload carrying capacity with extra high economy per ton load supported.

151 PILES

Raymond Concrete Pile Company—Standard and step-tapered piles are described in Catalog S-57 which also includes information on the scope of Raymond's activities covering every recognized type of pile foundation. Domestic operations include harbor and waterfront construction, and cement-mortar lining of pipelines in place. Raymond's services abroad also include all types of general construction.

152 PIPE DETECTRON

The Detectron Co.—A bulletin describing the Detectron 505 which does an amazingly accurate job in determining the location and depths of hidden pipes, valves, services, etc., is offered. Exclusive features of this instrument are explained and illustrated.

153 PLANT-MIXED ASPHALT PAVEMENTS

The Texas Co., Asphalt Sales Div.—The methods and materials employed in constructing the various plant-mixed types of asphalt paving for roads, streets, airports, parking areas, etc., are explained in a 20-page illustrated brochure. Types of construction covered by this publication range from heavy duty Asphaltic Concrete and Sheet Asphalt for major traffic arteries to relatively low cost asphalt mixes for light traffic.

154 PNEUMATIC OPERATED CONTROL

General Filter Co.—have published an eight-page bulletin No. 5421 on Pneumatic Operated Control. The P.O.C. system is ideally suited to all phases of the water treatment prices requiring instrumentation for measurement and/or control. Well illustrated and free on request.

155 PNEUMATIC TRANSMISSION SYSTEM

Simplex Valve & Meter Co.—A colorful and information-packed 8-page booklet, Bulletin 750, describes the Laminair, a form of pneumatic transmission which has been developed to provide a sensitive and accurate type of instrumentation. The mechanism produces an output air pressure that varies directly with flow through a venturi tube, flow nozzle or orifice plate, and which may be transferred and used to operate a distant receiving instrument.

156 POCKET TRANSIT

Wm. Ainsworth & Sons, Inc.—A booklet describing and outlining the use of the Brunton pocket transit and accessories is available. The booklet shows how horizontal and vertical angles can be determined to approximately one degree by an instrument weighing only 8½ ounces.

157 PORTABLE GASOLINE RAMMER

Barco Manufacturing Company—Offers an eight-page catalog describing the Barco portable gasoline rammer for soil compaction. This tool is the only successful mechanical means of obtaining specified soil compaction in restricted areas such as in trenches and near walls and bridge abutments. It is easy to operate, safe, and will compact 20 to 30 cubic yards of fill per hour where high degree compaction is specified. Barco also offers a bulletin "Cost Data for Soil Compaction in Restricted Areas with the Barco Rammer" of interest to all earthmoving contractors.

PLEASE BE PATIENT
YOUR REQUESTS TAKE TIME!

158 PRECAST FLAT-BASE PIPE

American-Marietta Co.—This pamphlet contains many photos and drawings showing the great versatility of Flat-Base Pipe. It is used as a pedestrian underpass and cattle pass; culvert under highways and railroads; tunnel for people and conveyor lines between buildings utility gallery conduit above ground and used inverted as a sidewalk. Also included in the folder is a chart giving complete data on sizes and weights available, etc.

159 PRECIPITATOR

The Permutit Company—Bulletin No. 2204C is a well-illustrated and documented 20-page pamphlet describing the many applications, principles of operation, design features, advantages, recommendations, flow diagrams and specifications of Permutit's precipitator. The precipitator offers, through its three basic designs, an efficient means of removing impurities from a liquid by precipitation, absorption, settling and filtration. Chief uses are in water softening, the reduction of alkalinity and the removal of turbidity, color, taste, odor, silica and fluoride.

160 PRECISION INSTRUMENTS

C. L. Berger & Sons, Inc.—"Solar Emphermeris and Polaris Tables," 1957 Edition, 96 pages, contains complete instructions for determining azimuths from the sun and the altitude of Polaris, has been prepared by Herman J. Shea, formerly Associate Professor of Surveying, Massachusetts Institute of Technology. Directions for making astronomical observations and computing results by direct solar observation and time from same observation; meridian by solar attachment; meridian by Polaris at elongation; azimuth by Polaris at any hour angle; latitude by sun at noon, and latitude by Polaris are included. Price is $.50 per copy.

N. B. There is a charge for this book. Make checks payable to C. L. Berger & Sons, Inc.

161 PRECISION INSTRUMENTS

The David White Instrument Co.—A new four-color catalog, unique in the field because of its completely modern format, typography. In addition to pictorial and descriptive information on the company's entire line of instruments new products are listed.

The
ENGINEER'S CREED

The American Society of Civil Engineers announces the availability of a new supply of "The Engineer's Creed," which originally appeared in the November, 1948 issue of CIVIL ENGINEERING. This new de luxe reprint, 8½" x 11", has been produced on lightweight parchment, and is suitable for framing.

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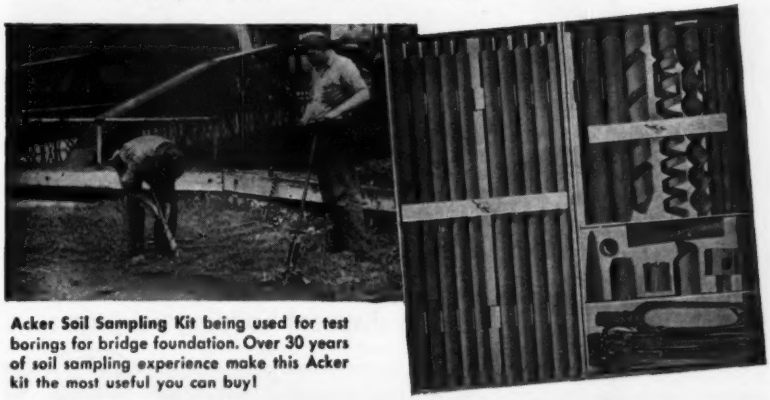

Acker Soil Sampling Kit being used for test borings for bridge foundation. Over 30 years of soil sampling *experience* make this Acker kit the most useful you can buy!

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CATALOG DIGESTS

162 PRECISION LEVELING

Filotecnica Salmoiraghi, Inc.—A new booklet covers use, maintenance and application of the Precise Automatic Level model 5190, a recent development of the medium type 5172. The instrument, provided with a self-setting reticle suspended in the preiscope-shaded telescope, features erect images, built-in micrometer reading to 1/10,000-ft, auxiliary aiming telescope and time-saving eyepiece, allowing simultaneous sighting on the rod, mircometer reading and checking of the automatic device.

163 PRECISION TRANSITS

Warren-Knight Co.—A new full page folder illustrating, describing, and explaining the 29 special features of the latest model, medium size, medium weight Precision Transits, Series 7 and 9, has just been issued. This new series Transits have many exclusive features which assure accuracy, ease, speed and convenience in handling, sturdiness, and a minimum of maintenance and repair cost. Price List is available without charge.

164 PREFABRICATED ASPHALT LININGS

Gulf Seal Corp.—Now in its second printing, a 24-page brochure details the experience of cities and industries in seepage-proofing a wide variety of projects using these linings. Specific projects reported on include several municipal drinking water reservoirs, industrial salt water storage pits, large irrigation canals for government, and industrial and municipal waterways of every type.

165 PRESSURE FILTERS

The Permutit Company—Bulletin 2225B describes Permutit's extensive line of pressure filters and their accessories. Specifications, operating characteristics, outline dimensions and typical installation photographs have been included in this edition.

In filling out the coupon, please print clearly and be sure that you furnish a complete address.

166 PRESTRESSED CONCRETE

Preload Company, Inc.—Two bulletins, No. T-14 and T-15, illustrating the extensive use and advantages of concrete tanks in the pulp and paper, cement and petroleum industry. Also contains design notes on typical problems that frequently must be solved in using Prestressed Concrete.

167 PRESTRESSED CONCRETE MATERIALS

Intercontinental Equipment Co.—Freyssinet-engineered material and equipment for prestressing. From a single supplier, contractors can get the full line of prestressed concrete materials and equipment. The basic components for any prestressed bridge job are Anchorage Units, Cable Assemblies, Tensioning Jacks, Hydraulic Pumps, Grout Mixers, and Grout Pumps.

168 PRE-TENSIONED BONDED PRESTRESSED CONCRETE

John A. Roebling's Sons Corp.—newest booklet on the application and production of this relatively new construction medium. One section is devoted to the details and operation of casting beds. Another section gives engineering data for tensioning strands. Another shows many typical structures as well as some new developments in this field.

169 PRICE LIST

Clipper Mfg. Co.—The current price list includes specifications of standard and the 2-H.P. SuperMatic Masonry Saws, Accessories, Concrete Saws and Abrasive, Break-Resistant and Diamond Blades. Colorful folders are available describing the new SuperMatic and Select-A-Notch Masonry Saws, the powerful self-propelled 36 H.P. Concrete Saw Model C-360; also the 25 H.P. Model C-250 and 14.6 H.P. Model C-146. A Hot Pour Model AC-40 Joint Sealer and Cold Applied Models CP-400 and CP-300 are described in circular 6004. Also listed are 29 direct factory branches.

170 RACEWAYS CATALOG

The Globe Co.—a new 28-page catalog on Globetray and Cable-Strut system of cable and tube raceways. Globetray was designed as a ladder type tray for uniform and easy installation while Cable-Strut is a basket type tray for supporting communication wire, instrument tubing and control cables for which the ladder type tray is not intended unless the cross channels were spaced closer together.

171 RAIL CATALOG

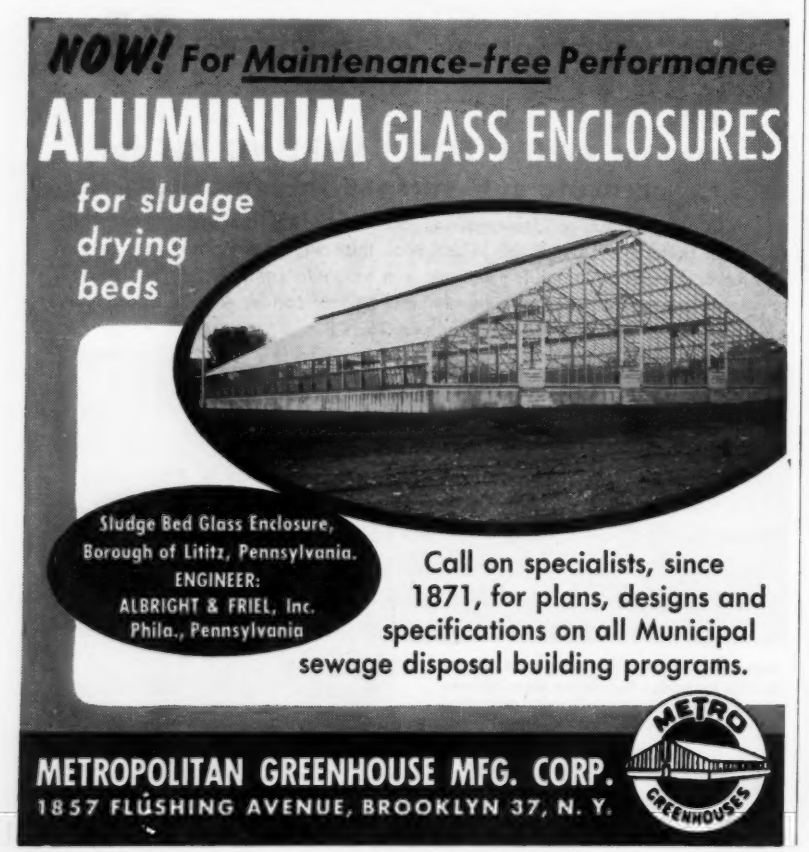
L. B. Foster Co.—Instructions on how to order rail and complete specifications of rail from 12-lb through 175-lb are contained in a 44-page catalog. Actual-size, dimensioned diagrams are used throughout to illustrate rail types. Data given includes weight information, section are dimentions and section properties. Conversion tables and special data on tee rail sections are included.

172 REINFORCED CONCRETE PIPE

American-Marietta Co.—this pamphlet covers elliptical Lo-Hed Reinforced Concrete Pipe for culverts and sewers. Specifications are given for the complete range of sizes from the equivalents of round pipe 18-in. I.D. through 144-in. I.D. Illustrations show results of pressure tests and installations of Lo-Hed pipe being made on various types of jobs.

173 REMOTE ELECTRICAL TRANSMISSION SYSTEM

Simplex Valve & Meter Co.—Designated the Orthoflow, this system for the accurate and rapid transmission of metering data from one location to another has been graphically illustrated in Bulletin No. 700. This well-documented 16-page bulletin describes the versatility of the system for transmission of flow data, liquid level data, or pressure measurement data. It contains diagrams of each type of application in addition to dimensional drawings and capacity charts.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CATALOG DIGESTS

174 REPRODUCTION MATERIALS

Graphic Reproduction Div., Eastman Kodak Co.—"Kodagraph Reproduction Materials" describes all materials available for the reproduction of engineering drawings and documents. Of special convenience to the user of these materials is a two-page materials selection chart designed to help in selecting the film and paper best suited to any job. The original to be reproduced is matched with the equipment to be used in this fully illustrated chart.

175 REPRODUCTION PROCESS

Charles Bruning Company, Inc.—Has made available an 8-page booklet explaining the principles used in the Copyflex whiteprint process. In addition to explaining the process, the booklet also describes its use in the engineering field and illustrates the complete line of Copyflex machines.

176 SAFETY GRIP-STRUT CATALOG

The Globe Co.—revised 12-page Safety Grip-Strut catalog showing the versatility of anti-skid material and how it provides a safe footing in all directions. Safety Grip-Strut is all one piece of material (steel or aluminum) and this catalog shows its application, with load charts, for floors, work platforms, stair treads and landings, running boards, partitions, balconies and aircraft repair docks. Complete list of fabricating distributors on back page.

RETURN THE COUPON TODAY FOR IMMEDIATE RESULTS!

177 SCREENING EQUIPMENT

Link-Belt Company—The complete Link-Belt line for efficient removal of solids from water, sewage and industrial waste is described in the 28-page book, No. 2587. Dimension and specification data for four types of course screens and three types of fine screens, plus tables to determine the proper size unit handling various capacities, are given.

178 SELF-LUBRICATING EQUIPMENT

Lubrite Div., Merriman Bros., Inc.—Manual No. 41 is a 20-page book filled with complete information, technical data, and specifications about Self-Lubricating bushings, bearings, and washers for industrial equipment, machinery and Hydro-electric type applications.

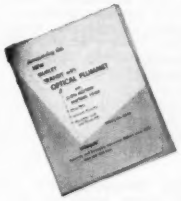
179 SELF-REDUCING PLANE TABLE ALIDADE

Kern Instruments Inc.—A new brochure gives exact details about the new self-reducing plane table alidade. This completely new instrument eliminates use of slide rule, offset scale and dividers. Actual working experience shows time in field cut by 50%.

New Optical Plummet Built into Gurley Transit Saves Set-up Time, Improves Accuracy on Windy Days

Years ago, Gurley introduced lightweight instruments to combat wind vibrations. Now Gurley further beats the wind problem with an optical plummet *built into* the instrument.

The new Gurley Optical Plummet Transit eliminates swing and sway of the cord and plumb—always time-consuming and exasperating on a windy location, and inaccurate as well. Positive accuracy of set-up is assured with the Gurley Optical Plummet.



The new Gurley transit is furnished with a tripod with built-in shifting head, and allows a two-inch shift of the instrument over the point. This provides greater latitude in initial set-up.

Gurley's new Optical Plummet Transit offers one of the advantages of the optical-reading theodolite *plus* the desirable features of simplicity and universal acceptance of the American transit. For further details, write for Bulletin OP-57.

GURLEY

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TIDE GATES

Fig. B-68, Type M
(CIRCULAR)

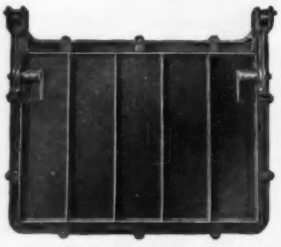

Fig. B-61, Type MM
(RECTANGULAR)

BROWN & BROWN, INC.
LIMA, OHIO, U. S. A.

CATALOG DIGESTS

180 SEWAGE TREATMENT LINE

Infilco Inc.—Bulletin 80CEC presents complete line of products for the treatment of water, sewage and wastes. Available literature is listed. Indices are provided as a ready reference by class, by trade name, by application. Enumerated is water treating equipment for municipal and industrial use in the fields of municipal water supply, process water for general industry, for power, by demineralization, for pulp and paper, for beverage use, and for swimming pool recirculation systems.

181 SEWER CONSTRUCTION

Superior Clay Corp.—One of a series of technical bulletins, "Good Practice in Sewer Construciton" offers detailed data on the preparation of the trench, its width, depth and type of bedding. Finishing, backfilling and proper inspection are also discussed.

182 SEWER STRUCTURES

Armco Drainage & Metal Products, Inc.—A 48-page manual points out the need for more efficient, economical sewers and describes eight types of sewer structures that meet every requirement. Some of the topics discussed are structural durability, material durability, selection of structures, factors influencing capacity, joints and fittings, and linings for failing sewers. The manual contains installation and design data, also reference data, illustrations, tables and useful charts.

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183 SLIPFORM EQUIPMENT

B. M. Heede, Inc.—"Concretor" Slipform Equipment Catalog—32-page job study catalog with 41 pictures and drawings. Detailed account of hydraulic system of slipform raising. Covers various applications of slipform such as apartment houses, silos—singular and multiple, bridge pillars, factory buildings, water towers, pithead buildings, mine shafts, etc. Inserts and editorial reprints on water tower, apartment house and bridge pillar construction. Equipment available on rental basis.

184 SLUDGE BED ENCLOSURES

Metropolitan Greenhouse—All-aluminum sludge bed glass enclosures, that are maintenance-free and superior to wood construction, are described in a new bulletin #656. Scientifically designed, these time-tested and proven alloys assure the ultimate in economy and durability for sludge bed enclosures. Plans, designs and specifications for all purposes are included in the bulletin. Electronic control of ventilation is another feature of this glass enclosure which eliminates many hours used in operating ventilation requirements.

185 SLUICE GATE

Rodney Hunt Machine Company—The first basic improvement in sluice gates in many years, the patented HY-Q flush bottom closure sluice gate, is described in Catalog 75. The newly released booklet, with 12-pages of illustrations, clearly shows all details of construction, installation, and operation of the unique gate as used in water filtration plants, power plants, municipal and industrial plants, drydocks, and flood control. Diagrams and text explain the many practical advantages offered by the HY-Q gate for water flow control. Complete recommendations for selection of frames and other equipment for sluice gates, as well as detailed specifications, series numbers, and clearance dimensions are also given.

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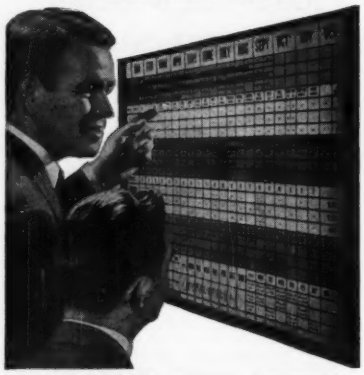

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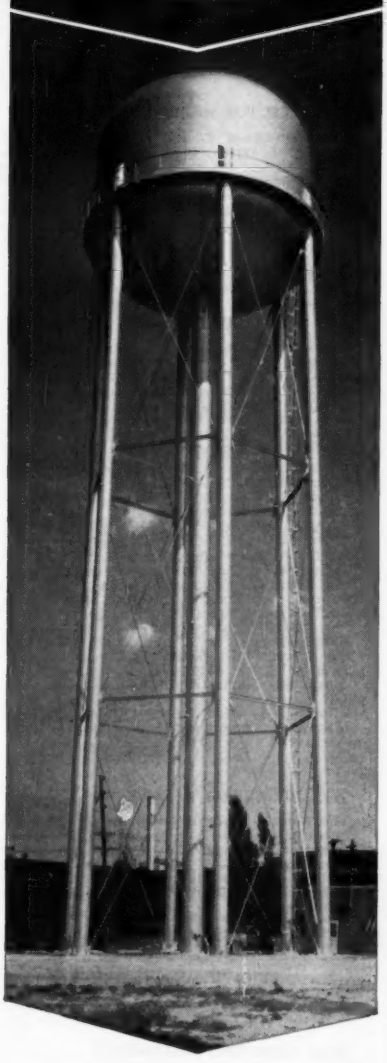

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CATALOG DIGESTS

186 SLURRY SEAL

American Bitumuls & Asphalt Co.—"Bitumuls Slurry Seal" is a new operation which consists of mixing fine aggregates with Bitumuls and water to a slurry consistency in a transit mixer, and spreading over the pavement by a specially constructed squeegee type spreader-box. The action of the squeegee forces the slurry into the fine cracks of a weathered but still sound surface of an old asphalt pavement, thereby reducing expensive maintenance patch construction to a minimum.

187 SNOW MELTING AND ICE REMOVAL

American Iron and Steel Institute—An informative 31-page booklet explaining steel pipe snow melting and ice removal systems is offered. Prepared by the Committee on Steel Pipe Research, the uses of these systems, their design, installations, advantages and tables are clearly illustrated.

188 SOIL COMPACTION

Vibroflotation Foundation Company—12-page booklet tells of method to compact loose granular soil to any required depth to 100-deg or more without need of piling or forms for footing. How used and what results can be obtained are described in proven applications for dams, bridges, and all types of foundations.

189 SOIL SOLIDIFICATION

Chemical Soil Solidification Co.—A set of publications consisting of reprints of articles that have been published at various times, are offered. These publications, particularly the Journal of American Water Works Assoc., pamphlet, "Chemical Soil Solidification and Chemical Sealing of Concrete" by C. M. Riedel, gives a broad cross section of the work being done and the possibilities of solving serious tunneling, foundation-setting, problems in the varied construction fields and maintenance work, including the fight against beach erosion and strengthening of underground shelters.

190 SOIL SOLIDIFICATION

Manu-Mine Research & Development Co.—"The Science of Soil Solidification" is the title of a new 10-page bulletin. Contents include a detailed explanation of what soil solidification is, the methods employed, and solidified soil characteristics. In addition, one section of the brochure deals with the applications of the process to highways, mines, foundations, piers, dams and piling.

191 SOLDER END BRONZE VALVES

Lunkenheimer Co.—Two-page Circular No. 603, details sizes, dimensions, types, and features of Solder End Globe, Gate and Check Valves, particularly suited for steam, hot and cold water lines; heating and air conditioning systems; oil, natural, and manufactured gas lines; underground water lines; and industrial uses.

192 SPEED REDUCERS

The Earle Gear and Machinery Company—A sixteen-page illustrated catalog, describing speed reducers as applied to operating machinery, particularly bridge machinery, is available. Outlined are specifications service factors, horsepower ratings and dimensions of the particular units illustrated. Gasoline power units are also dealt with in a compact, easy-to-read form. Photographs are shown of actual installations with miniature blueprints included.

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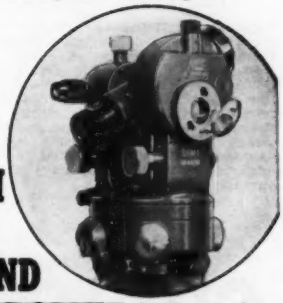

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193 SPIRALWELD PIPE AND COUPLINGS

Naylor Pipe Co.—Illustrated Bulletin 507 presents story on light-weight pipe for ventilating lines, air and water lines, irrigation pipe, etc. in diameters from 4 to 30-in. Includes standard fittings and welding flanges. Also covers data on one-piece Wedgelock coupling for fast, positive connection.

194 STAINLESS STEEL GRATING

Kerrigan Iron Works, Inc.—A 4-page catalog on stainless steel floor grating-open steel, contains engineering data and safe load table. Weldforged stainless steel grating is rust proof, chemical proof, non-magnetic and has a high heat resistance as well as high corrosion resistance. It is a boon to the chemical, oil and packing industries.

195 STANDARD AND NON-FREEZE STEAM COILS

Halstead & Mitchell—A new line of standard and non-freeze steam coils, using "Turbu-Flo" finned surface for extra high heat transfer, is described in detail in Bulletin S-200. The Bulletin describes construction of the coils, including tubing, casings, headers, refrigerant distribution, return bends and valves. Test and dehydration as well as means of specifying special coils are also described. Tables are devoted to dimensional data, male pipe connections and air friction through coils.

196 STEEL FORMS

Blaw-Knox Company—Bulletin 2430, illustrates and describes steel forms of concrete construction. Colorfully photographed in detail, the bulletin contains a number of the projects on which Blaw-Knox steel forms were used.

197 STEEL FORMS

Food Machinery and Chemical Corp.—Bulletin 200 presents complete information on the Form-Crete system of all-steel prestressed concrete casting forms. The various forms available for casting pilings, lintels, single T joists, double T slabs, I Beams and bridge deck sections are described. Fully illustrated with product photos and scenes of prestressed concrete construction it shows clearly how it is now possible to cast pre-stressed concrete on a mass production basis.

198 STEEL FORMS

United Steel Fabricators, Inc.—A "Leave-in-Place" steel form for concrete bridge flooring is a newly-developed product. Designed especially for form work on spans involving high or hazardous conditions, these forms are fabricated from trapezoidally corrugated galvanized steel sheets that can be left in place, thus eliminating entirely the need for wood form construction, shoring, safety nets and consequent stripping operations. Bridge schedules are speeded up, material waste is eliminated.

199 STEEL GRATING AND TREADS

Blaw-Knox Company—A 15-page booklet 2486, illustrating the advantages of actual one-piece construction as presented by Electro-forged steel grating is offered. Contains photographs of its many uses, types and spacing, fastening methods and a table of safe loads.

200 STEEL FOR HIGHWAYS

Bethlehem Steel Company—This 36-page illustrated booklet, "Steel for Highways," describes the broad range of Bethlehem steel products used in the construction of a modern highway. These include reinforcing bars, bar mats, dowel units, structural steel, wire rope, drill steel, pipe, guard rail and posts, fence and fence posts, sheet piling and H-piling, culvert sheets, rock anchor bolts, etc.

201 STEEL JOISTS

American Bridge Division—This 40-page catalog is the only steel joist catalog containing complete design information for spans up to 120-ft. Such subjects as design calculations, bridging, properties and dimensions, end details and accessories, load tables, marking systems for ordering, and specifications are clearly and completely covered in this catalog.

202 STEEL RIGID FRAMES MUTUAL

Martin P. Korn—Part one presents the fundamentals of analysis and design, including selection of type of frame, derivation of basic equations, and tables of design for single span frames of from 50 to 150 ft. Part two of the volume is a collection of actual designs of a number of structures: an auditorium, bridges, and others. Martin P. Korn is the author. (J. W. Edwards, Inc., Ann Arbor, Mich., 1953. 170 pp., $4.50.)

N. B. There is a charge for this book. Make checks payable to J. W. Edwards, Inc.

203 STRUCTURAL ARC WELDING

The Lincoln Electric Company—A continuing series of studies—how arc welding is used in modern structures—is issued periodically. Case histories of welded bridges, buildings and miscellaneous structures: drawings, details and calculations for typical structures are included.

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204 SURVEYING INSTRUMENTS

C. L. Berger & Sons, Inc.—A 16-page condensed catalog, "Accuracy in Action," illustrates the engineering and surveying instruments manufactured by the company. General characteristics, optical systems and accessories for the Berger line of engineers' transits, levels, mining transits, theodolites, collimators and alidades are fully described with essential specifications for each. A section devoted to builders' and contractors' instruments is also included.

205 SURVEYING INSTRUMENTS

Charles Bruning Company, Inc.—Brunson engineering transits and levels, which incorporate patented dustproof ball-bearing construction, are described in a brochure now available. The brochure describes how use of the ball bearing principle prevents costly maintenance, eliminates looseness in bearings, and permits operation in temperatures ranging from 70-deg below zero to 160-deg above zero. It also illustrates various models of instruments.

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206 SURVEYING INSTRUMENTS

Kern Instruments, Inc.—A 32-page brochure offers a brief description of the most important instruments manufactured by Kern & Co., Ltd., of Aarau, Switzerland. Fully illustrated, it acts as an index to the detailed literature available on each instrument. Included in the brochure are theodolites, levels, self-reducing tachometers, alidades, pentagonal prisms and many other instruments.

207 SURVEYING INSTRUMENTS

Fennel Instrument Corp. of America—This firm has added a new One-Second Theodolite, with several special features, to their complete line of Levels, Transits and Theodolites for all purposes. A brochure and other literature are offered, containing photographs, detailed descriptions of the instruments and prices.

208 SUSPENSION BRIDGES

John A. Roebling's Sons Corp.—"Bridge Division Products and Engineering Services" a new brainstorm book about the remarkably possible things that can be done with suspension systems. It's greatest single purpose is to show you what is now happening in this field and that these present exciting examples were, not very long ago, just ideas.

209 SWIMMING POOL DATA

Modern Swimming Pool Co., Inc.—Complete Catalog and Data book, No. 506 of swimming pool supplies, chemicals and equipment. It is a 52-page book, profusely illustrated, containing data, photographs and prices of every item needed to build a new residential or public pool, or to equip and maintain an existing pool. There is a section on pressure filter systems for both private and public pools; charts that enable you to select the proper size filter.

210 SWIMMING POOL EQUIPMENT

National Pool Equipment Co.—offers an informative 26-page catalog on complete equipment for new pools and repair of present facilities. This equipment is fully described in the booklet and in many instances detailed so that the designer may choose the equipment to serve the purpose intended. A price list and data sheet is also enclosed.

211 TAMPERS

The Jay Co.—gives detailed information on advantages and uses of **Jay Tamping Equipment** in all available sizes. A complete list of auxiliary equipment plus the explanatory material is also available. This catalog sheet is compact, complete, well illustrated and very easy to use.

212 TECHNICAL DATA CATALOG

Lefax Publishers—A newly revised 1957 catalog of pocket size technical data books is announced. These handy pocket books cover every field of engineering. The books contain 140 loose leaf pages of up-to-date material, concise, comprehensive and authoritative. Partial listing includes surveying, tables, highway engineering, general math, trig-log tables, reinforced concrete and piping data.

213 TECHNICAL DATA CATALOG

Lefax Publishers—A new revised catalog of Lefax Technical Data Books is now available. These pocket size reference books cover every branch of engineering, for use by engineers, technical workers, students, teachers and practical men. Each book has approximately 140 pages of authoritative data including current advances. Some of the subjects covered: Aeronautics, Air Conditioning, Automotive Engineering, Diesel Engineering, etc.

214 TEMPER-STEEL

Granco Steel Products Co.—Product Manual, BT-571, contains information on new concept in roof design. Tufcor is a deep corrugated tough-temper steel which functions as the structural roof deck. Sheets are furnished with a heavy hot-dip galvanized coating, insuring permanence and maintenance-free construction. Tufcor combined with insulating concrete fill provides a roof deck assembly with many unbeatable characteristics.

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215 TENNIS COURTS

American Bitumuls & Asphalt Co.—"Laykold Tennis Courts" is the title of a new 12-page, four-color booklet containing detailed specifications and color photographs of typical installations. There are sections on cost, maintenance, resurfacing and player acceptance. These bituminous courts offer resilient, grit-free, all-weather type surfaces.

216 TESTBORER DRILL

Penndrill Mfg. Div., Pennsylvania Drilling Co.—The testborer bulletin completely describes and illustrates the Model "B" Testborer drill which is a new development of this Division. The drill incorporates into one compact portable drilling unit the features of an Auger Drill, Core Drill and can automatically drive pipe and drive soil samplers with an exact 30-in. free fall hammer blow.

217 TESTBORING SUPPLIES & EQUIPMENT

Penndrill Mfg. Div., Pennsylvania Drilling Co.—A recently published Testboring Supplies and Equipment Catalogue illustrating and describing various testboring methods and equipment. It was written to give the layman a clearer understanding of sub-surface investigation.

218 THE EFFECTS OF CALCIUM CHLORIDE

Solvay Process Division—This is a 40-page booklet which is of interest to architects, engineers and others concerned with specifications, design or production of cement concrete. The booklet contains a variety of tables, graphs and charts dealing with the setting time, early strength, curing, density, surface wear, shrinkage and ultimate strength. Also shown are effects of varying temperatures and cold weather, and the results with special cements including air-entraining, high early strength and low heat cements.

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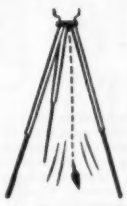

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219 THEODOLITE

Geo-Optic Company, Inc.—A leaflet describes the optical universal theodolite Askania Tu with a direct reading of one second and estimation 1/10 second. The Askania Tu Transit enables surveyors to cope with any possible problem of triangulation and to obtain result of the highest accuracy. All readings are done from one position—an important time factor. Other advantages and data are included.

220 THICKNESS DESIGN

The Asphalt Institute—Manual Series No. 1, a 44-page easy-to-handle manual contains information for the determination of the design thickness of flexible pavement structures. Covered are: Traffic Analysis; Material Analysis; Alternate Designs; and Economic Analysis and Selection of Design. An Appendix A outlines compaction requirements and Appendix B contains four examples of how thickness designs are determined. Price $.20.

N. B. There is a charge for this book. Make checks payable to The Asphalt Institute.

221 THREE-AXLE TANDEM ROLLER

Buffalo-Springfield Roller Company—The KX-25E tandem roller is featured in a new catalog. With exclusive walking-beam compaction control, the KX-25E is a heavy duty 3-axle tandem giving extra compaction where and when needed. Dimensions, specifications, weights, compressions chart and cut-away diagrams are included in the catalog.

222 THREE WHEEL ROLLER

Galion Iron Works & Mfg. Co.—Outstanding features of the "Chief", a three-wheel roller with Roll-O-Matic torque converter drive are illustrated with color photos. Attachments and specifications are included in Catalog No. 410.

223 THREE-WHEEL ROLLERS

Buffalo-Springfield Roller Company—Three-wheel rollers with powered hydraulic roll brakes and tapered roller bearings on all rolls, an exclusive performance feature of these rollers, is described in a 10-page catalog. Made for heavy-duty, they are variable in weight; the two models range from 10-14 tons and 12-15 tons.

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224 TORQUE MANUAL

P. A. Sturtevant Co.—A 27 page manual has been compiled at their laboratory to aid those persons responsible for torque control, specifications and applications. Detailed technical data on torque principles, designs, signaling devices, together with drawings and formulas is given.

225 TRACTOR SHOVEL

Allis Chalmers Mfg. Co.—Structural features of the HD-6G Diesel powered shovel are discussed, and the shovel hydraulic system of this tractor shovel reviewed, in a new two-color, 8-page catalog, MS-1101. Photographs, drawings and charts help convey the shovel's story of high output, long life, easy, time saving servicing and show the features built into the unit for operator comfort and safety. Also included are specifications and listing of interchangeable matched attachments designed and engineered to the HD-6G to increase its versatility and performance capabilities.

226 TRACTOR TOOLS

Hyster Company—An eight-page brochure describes the many Hyster tractor tools and their multiple uses when attached to Caterpillar-built tractors. The Hystaway excavator-crane, winches, "Grid" roller etc., are illustrated.

227 TRI-ACETATE SHEETS

Stanpat Company—circular describing their printed acetate sheets for speeding up drafting is available. These sheets are attached to original drawings and save draftsmen from redrawing standard details and repetitive notes. Resulting prints are clear and sharp and save tremendous amount of time.

228 TUNNEL AND MINE EQUIPMENT

Mayo Tunnel and Mine Equipment—New catalog insert No. 18 illustrates and describes mine cars, mine locomotives and the car-passer.

229 TUNNELS

Spencer, White & Prentis, Inc.—"Famous Subways and Tunnels of the World," by Edward and Muriel White recounts the fascinating history of subways and tunnels from earliest times. The price is $2.75.

N. B. There is a charge for this book. Make checks payable to Spencer, White & Prentis, Inc.

230 TURBO-DOZER

Clark Equipment Co.—More than 50 photographs arranged in film clip fashion illustrate the operation and correct application of the Michigan Model 180 Turbo-Dozer in a new 20-page booklet. Dimensional specifications of the Model 180 are shown on side and overhead view drawings. Engine, power train, and hydraulic system specifications are also listed.

231 TWO-AXLE TANDEM ROLLERS

Buffalo-Springfield Roller Company—A 12-page colored folder describes two-axle tandem rollers, which come in our different models ranging from 5 to 16-tons. With power roll brakes, superior vision design and bevel gear final drive, each feature of these rollers is fully explained in the catalog.

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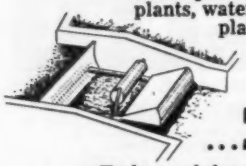

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CATALOG DIGESTS

232 UNCONFINED COMPRESSION TESTING

Soiltest, Inc.—A new 54-page manual on Unconfined Compression Testing of cohesive soils. The manual covers in detail the types of unconfined compression test apparatus, preparation of samples, detail test procedures, interpretation of test results and the use of these results in design and research activity.

233 UNDERPINNING

Spencer, White & Prentis, Inc.—"Underpinning," a book by Edmund Astley Prentis and Lazarus White is recognized as the authoritative source for information in the field by engineers, architects and contractors all over the world. The price is $10.

N. B. There is a charge for this book. Make checks payable to Spencer, White & Prentis, Inc.

234 VANE SHEAR TEST KIT

Acker Drill Co., Inc.—Acker Bulletin 700 describes a new vane shear test kit for obtaining in place soil shear strengths. Kit includes a complete set of attachments for making shear investigations to 100 ft depths in 2½, 3 or 4-casing pipe.

235 VERSATILE CAST IRON PIPE

Cast Iron Pipe Research Assoc.—A new illustrated booklet provides pictorial proof of the ruggedness and durability of cast iron pipe in water supply and distribution systems; feeder and distribution mains for the gas industry and sewer mains; and industrial service.

236 VERSATILE PILE HAMMER

Vulcan Iron Works, Inc.—The Model DGH-100 Portable Pile Hammer is the ideal hammer to meet the requirements of the smaller contractor. It is fully automatic and operates on any 100 C.F.M. air compressor or steam at 60-lbs pressure. The compactness and design makes it readily usable in close quarters. Some of its many uses and adaptability are described in Bulletin No. 30.

237 VERTICAL DRILLS

The Salem Tool Company—A four-page, two-color brochure explains the new heavy-duty drill Model 106-24 which is a companion drill to the 106-8. The vertical drills meet the requirements of weight, ruggedness, ease of operation, and versatility, and may be used in highway and turnpike construction, seismograph work, strip mine operation and stabilising hillsides and dams. A specification chart is included.

238 VERTICAL TURBINE PUMPS

Layne & Bowler, Inc.—A 72-page hard-back book entitled "The Answers to Your Questions about Layne Vertical Turbine Pumps," is ideal for quick reference, complete with cut-away diagram illustrations, pictures and charts and written by one of the foremost authorities on vertical turbine pumps. Request on your own letterhead.

239 VERTICAL WATER WELL

Ranney Method Water Supplies, Inc.—The newest development in the vertical waterwell field is the subject of a new brochure. Called the Vertube, it is a natural gravel vertical water well, designed exclusively for low volume users, at low cost. A diagram of the well completes the brochure.

240 VIBRATORY EQUIPMENT CATALOG

Jackson Vibrators, Inc.—Multiple Compactors for maximum consolidation of sub-base courses in macadam construction, fills, etc. Manually guided Compactors for paving blacktop walks, drives, pavement patching, widening, consolidation of granular soils in trenches, close to abutments, concrete floor sub-bases, etc.; Concrete Vibratory Screeds; Vibratory Tubes for Internal and Surface Vibration in Concrete Paving; General Construction Vibrators; Portable Power Plants.

241 VISUAL CONTROL

Graphic Systems—A 24-page illustrated booklet describing the Boardmaster Visual Control and picturing some typical applications. Over 100 photographs, sketches and diagrams are used to explain the operation of the system and show you how to get things done quicker and better. You type or write on cards and post on metal board to form horizontal and vertical columns. Cards are interchanged with finger-tip control. Plan Sheet enclosed with each booklet.

242 VITRIFIED CLAY PRODUCTS

Robinson Clay Product Co.—Completely new, four-page technical bulletin describes the full line of clay products. Designed for quick reference, the fully illustrated bulletin contains complete data specifications and dimensions for Vitrified clay pipe, clay liner plates, clay flue lining, lap-lok, wall coping, septic tanks, ventilator caps, vitrified clay terrace tile, Screw-Seal Industrial Pipe, perforated clay pipe, and the new Wedge-Lock Clay Pipe.

243 WALL COPING

Evans Pipe Co.—Comprehensive, eight-page, fully illustrated booklet describes the complete line of vitrified clay wall coping. Booklet details the advantages of flush, streamlined joints, interlocking and inter-sealing features, and lists dimensions.

244 WATERSPHERE AND WATERSPHEROID

Chicago Bridge & Iron Co.—"The Watersphere and Waterspheroid—Modern Elevated Water Tanks" is a 16-page brochure describing two types of water storage tanks. The modern structures are used in municipal and private gravity pressure for general service and fire protection, and this use is described in the booklet. The Watersphere is offered in standard sizes of 25,000-gal through 25,000-gal capacities, and Waterspheroid in capacities of 250,000-gal through 500,000-gal.

245 WATERSTOPS

Water Seals, Inc.—A colorful eight-page brochure illustrating a complete line of waterstops along with the particular job application of each is available. Polyvinyl waterstops are flexible enough to withstand extreme joint separation, yet are rigid enough to stand up to the battering effect of pouring concrete. The stops are unaffected by acid, alkalies, petroleum products, chemicals or adverse atmospheric conditions and will not rust, rot, check or crack.

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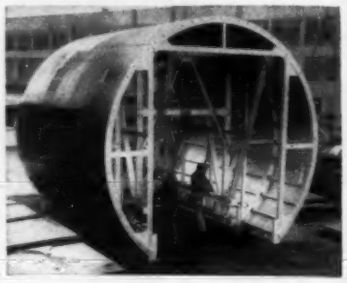

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Wednesday, June 5	
Conditions of Practice Luncheon	.....
Engineers' Party (Dinner & Dance)	.....
Thursday, June 6	
St. Lawrence Luncheon	.....
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CATALOG DIGESTS

246 WATERSTOP TECH-TIPS AVAILABLE

Electovert, Inc.—has ready for distribution, a complete series of Durajoint "Tech-Tips." This series of technical data sheets tells where, why and how to use Durajoint Waterstops. Graphically illustrates how to form-work, install, set-up and how to quickly and easily splice this Waterstop on the job. Covers many applications.

247 WATER SUPPLIES

Ranney Method Water Supplies, Inc.—The Ranney collector, infiltration gallery, and new vertube well are fully described and diagrammed in a four-page folder. These various methods provide a water program for every community, industry and budget. A list of foreign representatives is included.

248 WEDGE-LOCK CLAY PIPE

Robinson Clay Product Co.—Complete case-history report on successfully reducing infiltration and exfiltration by using Wedge-Lock Clay Pipe in new sewerage construction and existing systems, is described in a fully illustrated, four-page bulletin, AIA File No. 29B5. Complete description of the Wedge-Lock Joint adhesives, fittings and installation technique is included.

249 WEDGE-LOCK CLAY PIPE

The Logan Clay Products Co.—Completely new, four-page, fully illustrated Bulletin is available, describing the new Wedge-Lock Clay Pipe with the plastisol joint that snaps together in seconds. The factory-made Wedge-Lock joint is shipped ready for immediate installation and includes a complete line of matching fittings. Bulletin describes installation technique, advantages, and features of Wedge-Lock jointing.

250 WELDED GRATING CATALOG

The Globe Co.—new 8-page catalog on its newest product, Gold Nugget Welded Grating, showing general engineering data, safe loading charts and other specifications. Full description of projection welding and how it makes for greater rigidity and strength. Also offers three types of stair treads made with this heavy duty type of grating: one with plain nosing, another with diamond plate nosing and the third with abrasive nosing.

251 WELLPOINT-DEWATERING SYSTEM

John W. Stang Corporation—A 100-page revised edition of this catalog describes the component parts of the Stang wellpoint unwatering system; its planning, engineering and various methods of installation. Numerous recent projects have been added to demonstrate either a new application or some novel technical feature in the engineering and installation of the wellpoint equipment. Specific installations on dams, powerhouses, pipelines, tunnels, are illustrated from photographs made in the field. Heavy construction of all types in all varieties of soil conditions where ground water is encountered is described fully.

252 WELLPOINT SYSTEM

Moretrench Corporation—An informative 76-page catalog, fully illustrated, describes the Moretrench wellpoint system and its use in dewatering various types of construction projects. It includes useful technical data on the system.

253 WIRE ROPE FOR EXCAVATORS

John A. Roebling's Sons Corp.—"Wire Rope for Excavators" is chock-full of sound recommendations on where to use Royal Blue Wire Rope. It covers hoist ropes, dragline ropes, ropes for shovels, skimmers, scraper wagons, trench hoes, clamshell cranes, slacklines, derricks, drag scrapers and bulldozers. You'll also find supplementary data on wire rope constructions, diameters, weights and breaking strengths.

254 WOOD PRESERVATION

Wood Treating Chemicals Co.—The purpose of the booklet "What They Will Ask About Penta" is to provide information about this chemical creation. While not a new product—actually it was first used a century ago—Penta is not well-known to the general public. Questions such as what is Penta; how does it work; where can it be used, etc., are carefully discussed.

255 WOOD PRODUCTS

Timber Engineering Co.—A new 1957 catalog describing in full detail, with photos, Teco products and services for users of wood and forest products is available. Connections, tools and framing anchors are discussed. Design, consultation, research and development in the timber field is also included.

256 WOOD & STEEL TYPE DOORS

The Kinnear Mfg. Co.—The catalog and data book discusses fully and illustrates the advantages, the economy, the construction features and the general specifications of the various types of wood and steel upward-acting type doors. Known as Bulletin 93 it gives information on installation, clearance requirements, methods of operation and controls, as well as adaptability of the doors for many types of uses.

257 ZEOLITE WATER SOFTENERS

The Permutit Company—Bulletin 2386-B, describes troubles caused by the utilization of hard water and the multiple economies effected by curing them. This 20-page bulletin should be of interest to all engineers dealing with water problems. Equipment specifications, operating characteristics, data on Permutit ion exchange resins and typical installation photographs have been included in this new edition.

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PROCEEDINGS AVAILABLE

For instructions and key to abbreviations, see next page. Each member is entitled to 100 different "Proceedings Papers" yearly, ordered from these pages, plus all papers of the Technical Divisions in which he registers. The latter papers will be mailed automatically. Discussion of a paper will be received during the four full months following the month of issue.

February

1173. Sludge Digestion or Incineration, by Eugene R. Davis. (SA) The factors determining the economics of digestion versus incineration are so dependent on local conditions that no general conclusions can be reached for all conditions. It is shown that each problem is specific in itself.

1174. Calculation of MAC of Radioactivity in Air and Water, by Herman Cember and M. A. Shapiro. (SA) Radiation damage is proportional to absorbed energy, which provides a means for computing MAC values for many radioactive environmental contaminants. These values are based on a maximum exposure rate of 300 millirem per week, corresponding to the absorption of 30 ergs per gram of tissue for beta or gamma radiation. If the biological behavior of any particular radioisotope is known, then the maximum permissible contamination may be computed that would result in exposure at this rate.

1175. Selection of Sites for Atomic Energy Plants, by Arthur E. Gorman. (SA) Careful site selection for atomic energy plants is a most important advance planning function. The most significant environmental elements affecting site selection are the geology, hydrology, and meteorology of the area.

1176. SED Research Report No. 11: Status of Refuse Collection and Disposal, by The Sanitary Engineering Research Committee, Refuse Section. (SA) A preliminary survey was completed during 1955-1956 concerning the present status of refuse collection and disposal as well as future needs for additional research and development. The results of this investigation are summarized and evaluated.

1177. Discussions of Proceedings Papers 716, 826, 838, 1009, 1015, 1034. (HY) Joseph M. Caldwell closure to 716. W. B. Langbein and C. H. Hardison closure to 826. Ven Te Chow closure to 838. J. E. Flack, John L. French on 1009. Guido di Ricco on 1015. Sam Shulits on 1034.

1178. Some Engineering Aspects of High Rate Composting, by John R. Snell. (SA) Composting, one of the least known methods of garbage and refuse disposal, is currently being considered as an important means of conserving natural resources and of disposing of solid wastes. Factors affecting high-rate composting are cited.

1179. Writing Engineering Specifications—For Quality, Not Price, by Morris M. Cohn. (SA) This paper shows that a major engineering problem in public works is specification writing because stress is too often placed on price rather than on quality. However, there is a tendency to improve specifications so that quality is first and price, second.

1180. Color in Industrial Wastes, by Nelson L. Nemerow. (SA) Modern theories of color formation are reviewed and summarized with special emphasis on the role of chemical structure in color development. Commercial dyes are classified according to their structure. The azo group of dyes, representing about half of the commercial dyes manufactured at present, was selected for experimental laboratory studies. Reduction with $SnCl_2$ and salting with NaCl were most effective in reducing and changing the color of methyl orange, a monoazo dye.

1181. Allegheny County Story of Smoke and Air Pollution Control, by T. C. Wurts and J. J. Grove. (SA) Ever since the 19th century, the Pittsburgh area has been troubled by air pollution. The development of smoke and air-pollution control in Allegheny County is an excellent example of what can be accomplished by cooperative efforts of an entire community.

1182. Arch Dams: Measurements and Studies of Behavior of Kamishiiba Dam, by H. Kimishima and C. C. Bonin. (PO) This paper, one of three, describes the actual behavior of the first large arch dam in the Far East. A description is included of the instruments, their arrangement, and the results of preliminary investigations. Data is presented on joint openings, deflections, stresses, and temperature variations in both concrete and foundation rock.

1183. Arch Dams: Construction of the Kamishiiba Dam, by K. M. Mathisen and C. C. Bonin. (PO) This paper, one of three, discusses the construction of the first large arch dam in the Far East. The construction plant and equipment, foundation excavation and grouting, quarry operations and aggregate production, concrete control, construction operations, contraction joint grouting, and the closure of the dam are described.

1184. A Supplemental Note on Valuation and Depreciation, by Maurice R. Scharff. (PO) This paper supplements two previous papers by the writer by citing the applicability of computations of equal sums, of present worths of annual fixed charges, and of operating expenses for alternative proposals to the solution of other engineering-economic problems and to the valuation and de-

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preciation of public-utility property. Algebraic formulas and numerical examples are presented for a number of selected typical cases.

1185. Discussions of Proceedings Papers 639, 739, 895, 991, 997, 1042. (PO) Louis E. Rydell and Glenn H. Von Gunten closure to 639. William Whipple closure to 739. Glenn H. Von Gunten, Hugh A. Smith, Jr., and Berton M. MacLean closure to 895. Judson P. Elston on 991. Fred A. Houck on 997. James Park on 1042.

March

1186. The Vibration of Simple Span Highway Bridges, by John M. Biggs, Herbert S. Suer, and Jacobus M. Louw. (ST) An analytical method for predicting the magnitude of highway-bridge vibration due to vehicular traffic is presented. Results obtained by this method are shown to compare favorably with laboratory experiments and actual field tests. Final theoretical results are presented in chart form for practical application.

1187. Analysis of Multiple-Span Continuous Trusses, by Benjamin C. F. Wei. (ST) This paper presents the method of the moment-influence line as a tool in analysing multiple-span continuous trusses. For simplicity and ready adaptation of this method for use in design offices, solutions are given in tabular form. A numerical example is included showing the complete analysis of moment-influence lines for a 4-span continuous truss.

1188. Resistance to Overturning of Single, Short Piles, by E. Czerniak. (ST) This paper presents practical aids for stress analysis and lateral force design of short piles which will effectively reduce the labor ordinarily required for their solution. Specifically, the paper was prepared for those engineers concerned with foundation design in refineries and chemical plants.

1189. Confirmation of Inelastic Stress Distribution in Concrete, by Eivind Hognestad. (ST) Studies regarding inelastic stress distribution in flexure of reinforced concrete members are reviewed, and the results obtained are compared with the recommendations of the Joint ASCE-ACI Committee on Ultimate Strength Design. Test results show that the inelastic concrete stress distribution consists of a rising curve from zero to the maximum stress and a descending curve beyond the maximum stress. The Joint Committee design coefficients are well substantiated by test results.

1190. Design of Flexible Steel Arches by Interaction Diagrams, by Haaren A. Miklofsky and Omar J. Sotillo. (ST) A direct method of structural design for all types of flexible steel arches by means of interaction diagram is presented. The design method is illustrated by the design of the quarter point sections of the following steel arch bridges: The two-hinged Rainbow Bridge, the Bayonne Bridge, and the hingeless Rainbow Bridge.

1191. Prestressed Truss-Beams, by Ralph L. Barnett. (ST) This paper presents a design procedure for simply supported beams which makes possible the utilization of statically indeterminate composite action and favorable initial stress distribution to strengthen available beam sections. A variation of the Queen Post truss with a pretensioned tie rod is studied, and weight savings of more than 30% are demonstrated. The techniques used are based entirely on elastic considerations.

1192. Discussions of Proceedings Papers 764, 825, 828, 914, 920, 1023, 1054, 1055, 1057, 1058, 1100, 1106. (ST) Lynn S. Beedle closure to 764. George F. Collins closure to 825. Alexander H. Kenigsberg closure to 828. Andrew John Pyka closure to 914. George Winter closure to 920. Pranab Kumar Chaudhuri on 1023. A. A. Eremin, C. Neufeld, E. A. Richardson on 1054. R. L. Kemp and A. H. Mattock; Dean Kamaras on 1055. T. Au, W. Watters Pagon, Sandi Pado Bennerjee, M. G. Salvadori on 1057. John C. Murphy, Thomas D. Y. Fok on 1058. Ludwig Adams on 1100. Thein Wah on 1106.

1193. Design and Strength of Welded Pipe Line Branch Connections, by E. C. Rodabaugh and H. H. George. (PL) The design of pipeline branch connections is on an empirical basis because no suitable theoretical analysis is available. Code requirements, loadings, and field failures are briefly discussed. Extensive test data on pressure and external loadings, both of a static and cyclic nature, are presented.

1194. Flow of Natural Gas in Pipelines, by William T. Ivey and James H. Dorough. (PL) Consideration is given to the various flow formulas used in designing natural gas transmission pipelines. The need for a standard formula based on maximum efficiency against which actual line performance may be compared is emphasized. The merits of a proposed form for this standard equation are presented.

1195. Prediction of Surge Pressures in Oil Pipelines, by Robert D. Kersten and Edwin J. Waller. (PL) This paper outlines a method of analysis of surge problems based on a fundamental mathematical approach. The validity of this method is demonstrated through application to a field-scale pipeline system. Future applications of this method should result in increased knowledge of "surge" conditions, and, hence, in better over-all designs and appreciable financial savings.

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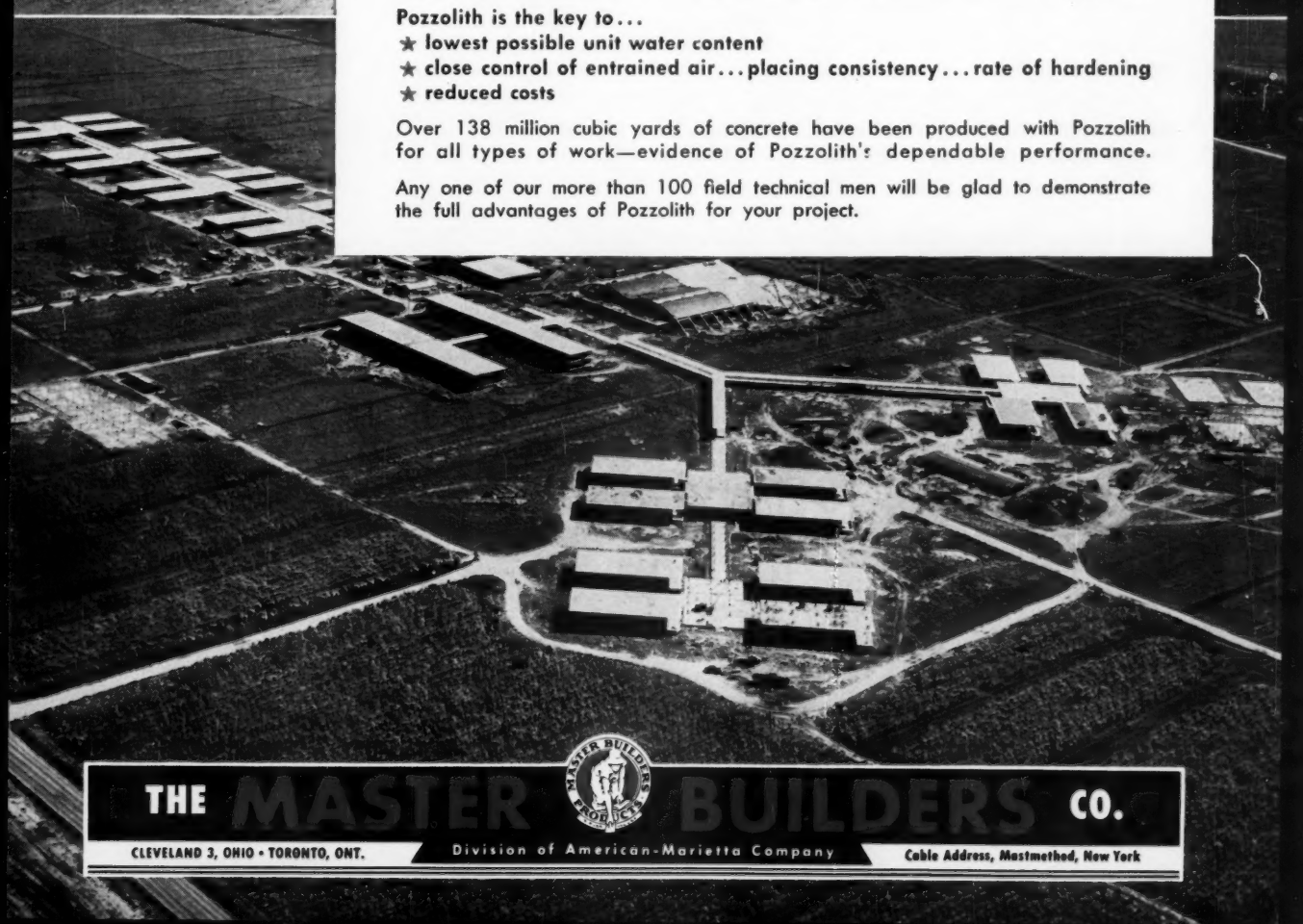

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